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MEDICAL AND SURGICAL REPORTS

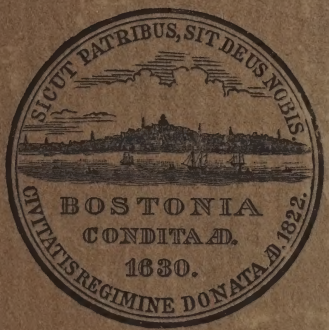
OF

THE BOSTON CITY HOSPITAL.

Fifth Series.

EDITED BY

DAVID W. CHEEVER, M.D., GEORGE B. SHATTUCK, M.D.,
AND ABNER POST, M.D.



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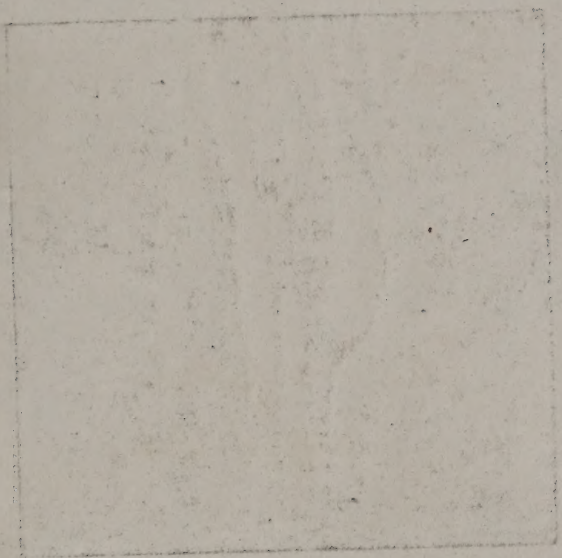

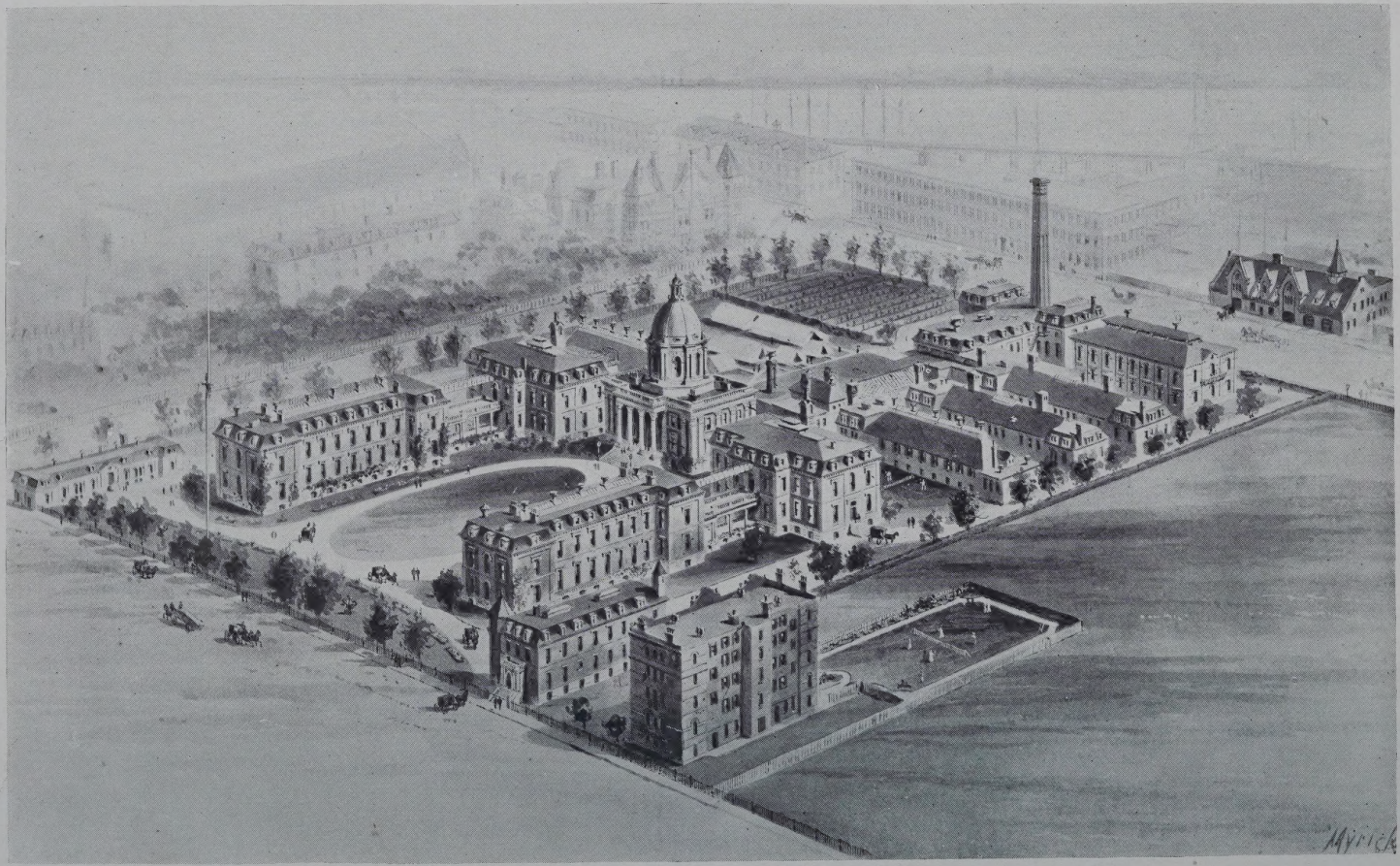

THE BOSTON CITY HOSPITAL, 1893.

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DAVID W. CHEEVER, M.D., GEORGE B. SHATTUCK, M.D.,
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PREFACE.

In presenting the Fifth Series of the Medical and Surgical Reports of the Boston City Hospital, the editors desire to call attention to the growth of the Hospital, which now contains five hundred beds, and to the completion of its thirtieth year.

Since the publication of the last volume, the consulting board has met with a loss in the death of Doctor Fitch Edward Oliver, long an ornament to its staff. The visiting staff has also suffered from the untimely removal by death of Doctor Orlando W. Doe, who devoted much of his life and usefulness to this institution. It has been similarly deprived of the long services of Doctor George H. Lyman, medical director in the Civil War, and for many years a valued associate on our hospital staff. Contagious diseases have cut off, in their early manhood, two most promising lives, in our deceased house-officers, Doctor Lorenzo W. Tuck and Doctor Walter Gay Stebbins.

The Editors.

May, 1894.

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SURGICAL CASES.

BY

DAVID W. CHEEVER, M.D.

I. — STAB PENETRATING KIDNEY; LONG-CONTINUED HEMORRHAGE INTO BLADDER; REMOVAL OF ENTIRE KIDNEY THROUGH THE LOIN; RECOVERY.

II. — THE COMPARATIVE RESULTS OF MY TWELVE HUNDRED AND THIRTY-EIGHT SURGICAL OPERATIONS DONE AT THE CITY HOSPITAL, FROM 1864 TO 1890.

I.

STAB PENETRATING KIDNEY; LONG-CONTINUED HEMORRHAGE INTO BLADDER; REMOVAL OF ENTIRE KIDNEY THROUGH THE LOIN; RECOVERY.

By David W. Cheever, M.D.

G. C., 25 years old. *Present Illness.* — Patient states that on last Wednesday evening (Nov. 9), after some altercation with his wife, she stabbed him in the right loin, the instrument used being a pair of shears, as he supposes. There was free bleeding from the wound for some time. The next morning on viewing his urine he noticed that it was bloody. He also passed some clots. Hematuria has continued. Passes his urine frequently and in small amounts. Micturition is accompanied by considerable pain, referred to neck of bladder and to the end of penis. Urine is bloody throughout entire micturition.

Urine. — Dark; sp. gr. 1026. Acid. Albumen, one-half per cent. Sediment, much blood and coagula. Microscopically; field entirely filled with blood, both normal and abnormal.

Physical Examination. — Well developed and nourished. Pulse regular and of good strength and volume.

Heart and lungs negative.

In the right loin, midway between the last rib and the crest of the ilium, there is a small transverse punctured wound one-half inch in length. Wound is sealed with a sero-bloody coagulum. There is slight tenderness on pressure about the wound. Hematuria, as above described. Physical examination otherwise negative.

Treatment. — Urine is very bloody and is passed at frequent intervals, considerable pain attending the act. Rest in bed ordered and the administration of Fl. Ext. Ergot, ♏ x, 3 times a day.

November 16. Patient is still passing blood freely in urine. Micturition frequent but less painful than at entrance. Passes larger amounts of urine daily. Total yesterday was ʒ 70. Has no pain except that which attends the act of micturition. General condition good.

℞. Gallic Acid, grs. x, every 2 hours.
Fl. Ex. of Ergot, ♏ x, every 4 hours.

November 19. Still passing large amounts of urine (50 ʒ yesterday), which is very bloody. Has considerable pain.

Sol. Morphia, ʒ i (gr. $\frac{1}{8}$), for pain.

Patient has a burning sensation, which he refers to the end of penis. At times is unable to pass his urine, although there is an irrepressible desire so to do. The pain at these times is excruciating. This is apparently due to clots which are dislodged and plug the urethra. Relief is obtained by the passage of a soft rubber catheter and washing out the bladder. As there has been no improvement, Dr. Cheever to-day decided that surgical interference was necessary.

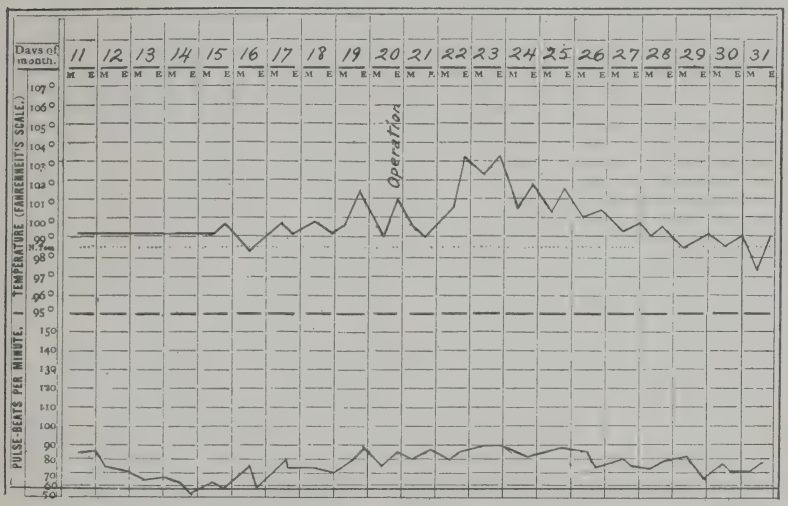
Now ten days since the injury.

November 20. Parts aseptically prepared last evening.

Ether Operation. — Patient having been etherized and placed on his left side with a pillow under his flank, an elliptical incision, about four inches in length, was made transversely in the right loin, about one inch below the punctured wound. A probe introduced into the original wound passed only to the depth of one-half an inch, as the bottom of the skin-wound was closed. Dissection was carefully carried through the fascia, the external and internal oblique muscles, and the aponeurosis of the transversalis, until the perinephritic fat tissue was exposed. Surrounding and infiltrating this was a large mass of coagulum. The retroperitoneal space was thus opened; the belly of the quadratus lumborum forming the posterior boundary of the wound. The perinephritic fat was divided with the scissors, and the clot turned out. Bleeding vessels in the lips of the wound were caught and ligated. The finger being introduced into the wound, the kidney was brought down into sight. This was rendered somewhat difficult owing to the position

of the kidney being well up underneath the ribs. To the lower and posterior surface of the organ there was adherent a large blood-clot. On the lower and external lateral surface of the kidney there was an irregular lacerated wound penetrating its structure. With a pair of vulsellum forceps the kidney was drawn forward into the wound. A pair of Tait's

CLINICAL CHART.


Days of month.
11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31
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Operation
PULSE-BEATS PER MINUTE. | TEMPERATURE (FAHRENHEIT'S SCALE.)
107 106 105 104 103 102 101 100 99 98 97 96 95
150 140 130 120 110 100 90 80 70 60 50

angular pedicle forceps was then introduced, and the renal vessels and ureter clamped about one inch from the organ. An aneurism needle, threaded with heavy braided silk, was passed about the renal vessels, and the artery and vein ligated together. The ureter was secured separately in the same manner. The entire kidney was then removed *en masse* with the knife. On the removal of the clamp forceps there was some free bleeding from the stump. This was controlled by passing two ligatures about the bleeding points. The wound was thoroughly flushed with corrosive 1-5000, and the operation completed by approximating two-thirds of the outer portions of the wound with interrupted silk sutures; the central portion being packed with baked gauze. The wound was dressed with baked gauze and a swathe. Patient's condition remained good throughout the operation, and he made a good recovery from ether.

November 23. Patient is fairly comfortable. Is now passing a pale, though somewhat turbid urine, but entirely free from blood. For the first thirty hours after the operation the urine continued bloody and was filled with coagula, and micturition was attended by intense pain, referred to the end of the penis from the plugging with clots. This was relieved by catheterization and irrigating the bladder. These symptoms are now entirely relieved. The wound was dressed for the first time to-day. The dressing was considerably stained with a sanguineous discharge. Wound in excellent condition; no suppuration. The packing was removed.

The daily total amount of urine passed by the patient before and since the operation is as follows: November 15th, 73 ʒ; 16th, 89 ʒ; 17th, 135 ʒ; 18th, 60 ʒ; 19th, 30 ʒ; 20th, 37 ʒ (*day of operation*); 21st, 37 ʒ; 22d, 42 ʒ.

November 27. Urine, pale acid, 1022. Albumen, one-eighth per cent. Sediment, slight. Pus free and in clumps. Neck of bladder cells, squamous epithelium. Some normal and abnormal blood.

27. Patient passes urine freely and without difficulty. Temperature is normal. Wound is in good condition. There is a slight, thin puriform discharge, which is washed out by irrigation. One stitch at the edge of the wound has separated. The rest have healed, and the wound along the line of sutures has entirely united, firmly. Daily amount of urine is as follows: 23d, 48 ʒ; 24th, 40½ ʒ; 25th, 62 ʒ; 26th, 39 ʒ.

December 1. Patient is comfortable; complains of no pain. Wound dressed every third day. Central portion, where it was packed, slowly filling in with granulation. No suppuration. Appetite good. Stitches removed three days ago. Daily amount of urine since last note is as follows: 27th, 57 ʒ; 28th, 31 ʒ; 29th, 39 ʒ; 30th, 54 ʒ.

December 7. Is in good general condition. Wound is doing well. There is a cavity about two inches wide by two inches in depth when gauze was removed, which is granulating in. (Is passing between 30 and 86 ʒ of urine daily.)

December 14. Wound is filling in rapidly. Patient complaining of no pain. Very slight discharge on dressing.

December 20. Urine, pale acid, 1016. Albumen, one-

fourth per cent. Sediment, few hyaline casts, occasional renal cell. Few leucocytes. Uric acid crystals and granular detritus.

December 21. Patient has been up and dressed for two days past. Wound has healed, except for small opening about one inch long and one-half in depth, which is granulating. Very slight discharge. Daily amount of urine averages between 40 and 70 ℥.

December 22. Patient leaves the hospital to-day. General condition excellent. Wound in same condition as noted yesterday. Is to return to the Out-patient Department for further treatment.

Discharged relieved, one month after operation.

DR. COUNCILMAN'S REPORT.

The entire right kidney sent for examination. It is of ordinary size, pale and anæmic. On the posterior surface there is a large adherent blood-clot. There are several large irregular ruptures on the surface, probably made in removal. On the lower portion of the kidney, on the lateral surface, about 3 c.m. from the lowest portion, there is an irregular lacerated wound going deeply into the renal tissue. The wound is in shape as drawing. The long edge of the wound is $1\frac{1}{2}$ c.m.; in the angle coming from this is $\frac{3}{4}$ c.m. The wound passes directly into the kidney into the nearest calyx, then into and across the pelvis into the opposite side. The lacerated wound into the pelvis is filled with a tolerably firmly adherent blood-clot. Just above the point of entry of the wound there is a large anæmic infarction of the kidney $2\frac{1}{2} \times 2$ c.m. in size. This infarction extends down into the pyramid. The edges of this are hemorrhagic. Directly opposite this, in the direction of the wound, there is another and smaller infarction, with extensive hemorrhage in the renal tissue around it. There is some laceration of the renal tissue at this point. There is a firm organized thrombus adherent to the surface of the kidney at the smaller infarction.

The entire organ and section is dry and anæmic. The cortex is very pale, and there are numerous white opaque points in the tissue. The two renal arteries, free from clot, are found in the pelvis. The vein is free from clot. On

microscopic examination there are numerous small foci of fatty degeneration throughout the kidney. The instrument causing the wound passed into the lower lateral surface of the organ. It passed at the base of a pyramid, destroying the artery and producing an anæmic infarction of the portion by this. It then passed across the pelvis into the tissue on the other side, destroying another artery, with the production of the smaller infarction. It could not be said whether these lacerated vesses became occluded from thrombus, and the hemorrhage took place from the lacerated parenchyma, or whether the torn arteries continued to bleed.

II.

THE COMPARATIVE RESULTS OF MY TWELVE HUNDRED AND THIRTY-EIGHT SURGICAL OPERATIONS, DONE AT THE CITY HOSPITAL, FROM 1864 TO 1890—THE LARGER PORTION PERFORMED BEFORE THE DISCOVERY AND USE OF ANTISEPSIS; WITH A RATIO OF RECOVERY OF 85+ PER CENT., AND A MORTALITY OF LESS THAN .15 PER CENT.

By David W. Cheever, M.D.

ABSCESSES INCISED.

	No.	Recovered.	Died.
General, but considerable	60	58	2
Deep cervical abscess	4	4	
Abscess tonsil	3	2	1*
Abscess hip-joint	5	3	2
Abscess knee	1	1	
	73	68	5

* Pneumonia.

Felons and small suppurations not included.

AMPUTATIONS.

Hand, partial of	22	22	
Arm and fore-arm	20	18	1*
Shoulder-joint	5	3	2
Foot, partial of	4	4	
Leg	29	22	7
Both legs	1		1
Knee-joint	2	1	1
Thigh	26	14	11*
	109	85	24

* One uncertain.

Single phalanges, etc., not included.

Amputation of the Thigh.

	No.	Recovered.	Died.
Traumatic primary	9	1	7*

* One uncertain, probably fatal.

Six died in from thirty minutes to twenty-four and forty-eight hours; one died in three days.

These all died of shock, after crushing injuries; none died on the table; the one uncertain was hurried away by friends, but looked unfavorably.

	No.	Recovered.	Died.
Traumatic secondary	3	2	1

The fatal case was from shot-wounds, and died of septicæmia.

	No.	Recovered.	Died.
Pathological	14	11	3

One died of phthisis; one after amputation for gangrene; one after *two* reamputations.

Amputation of Leg.

	No.	Recovered.	Died.
Traumatic primary	9	6	3
Traumatic secondary	6	4	2
Pathological	14	12	2

There was no amputation at the hip-joint.

Amputation of Breast.

	No.	Recovered.	Died.
Amputation of breast	51	50	1

The single fatal case died of effusion into the pleural cavity. At the autopsy, unsuspected cancer of the pleura and liver was found. She died in five days after removing the breast. Axilla not involved.

In these cases the axilla was dissected out only if glands were felt to be enlarged and recognizable.

In my opinion the dissection of the axilla adds largely to the shock, and impedes rapid convalescence, in some cases.

EXCISIONS.

	No.	Recovered.	Died.
Of scapula	2		2
" shoulder	1		1
" elbow	10	9	1
" wrist	1	1	
" hip	15	9	6
" knee	3	1	2
" ankle	2	2	
" tarsus	1	1	
" eye	3	3	

The excisions of the scapula both died of shock. One was for sarcoma in a woman of 35 years; one was for humid necrosis in a boy of 12 years. In both cases the arm was not amputated. The excision of the shoulder died of phthisis.

Five excisions of the hip died of exhaustion, and of secondary tubercular, or amyloid changes. One died of tetanus.

One excision of the knee, aged $2\frac{1}{2}$ years, lived, but was finally amputated. One, aged 4 years, died of exhaustion after one month. One, aged 2 years, died of septicæmia.

	No.	Recovered.
Bursæ	5	5

BONES.

	No.	Recovered.	Died.
Trephining head for fractured skull	9	2	7
Compound depressed fracture elevated	2		2
Trephining mastoid	1	1	
Trephining antrum	1	1	
Trephining tibia	1	1	
Trephining vertebræ	1		1
Leontiasis	2	2	
Caries, extremities, pelvis, ribs, face	15	14	1
Periostitis incised	4	4	
Necrosis and sequestrotomy	70	68	2
Excision of upper jaw	18	14	4

MOUTH AND THROAT.

Amputation tongue, cancer	5	3	2
For lupus	1	1	
Pharynx and tonsils, tumors of, removed by external incision	4	4	

	No.	Recovered.	Died.
Naso-pharyngeal polypi, removed by displacing jaw or nose	5	5	
Double displacement	1		1
Removal through ala of nose	2	2	
One cystic sarcoma near eye	1		1
Bronchocele by excision	5	3	2

One died after a severe operation for double goitre; one died after the use of setons, of sepsis.

LARYNX.

	No.	Recovered.	Died.
Laryngotomy or thyrotomy	7	6	1
Intubation	2		2
Tracheotomy	64	24	40
Mortality = 62½ per cent.			
Ratio of recovery = 37½ per cent.			
Tracheotomy for croup or diphtheria	50	14	36
Tracheotomy for œdema, burn, cancer, or syphilis	6	4	2
Tracheotomy for cut throats	6	4	2
Tracheotomy for foreign bodies	2	2	
	64	24	40
Œsophagotomy for foreign bodies	5	3	2

ABDOMEN.

Hernia.

Operation for radical cure	30	29	1
Operation for strangulation	34	21	13

Laparotomy.

Ovariotomy	7	3	4
Hysterectomy	4		4
Paracentesis	2	2	
Uterine polypi	4	2	2
Intussusception	1		1
Volvulus	1		1
Cancer intestine	1		1
Pylorectomy	1		1
Colotomy	2	2	
Abscess and appendicitis	9	9	
Laparotomy for purulent peritonitis	2	1	1
	34	19	15

Blood-vessels.

	No.	Recovered.	Died.
Aneurism	6	4	2
Ligature of arteries	13	7	6

Genitals.

Amputation penis	6	6	
Circumcision	7	6	1*
Incision for paraphimosis	7	7	
Incision for phageduena and chancres	6	6	
Castration	5	4	1
Hydrocele	15	15	
Injected	9		
Laid open	5		
Seton	1		
Varicocele	7	7	
Ligated	3		
Excision of veins	1		
Excision of scrotum	3		
Incision and ligature for rupture spermatic vein	2	2	
Varicose veins ligated	4	4	

* Apoplexy.

Stricture of Urethra.

Dilatation	17	17	
Divulsion (Holt's)	10	10	
External urethrotomy	8	8	
Internal urethrotomy	2	2	
Cock's operation modified (three times for extravasation)	7	3	4
Syme's operation (two times for extravasation)	6	5	1
Aspirations over pubes	7	7	
Tapping through rectum	2	2	
	59	54	5

Bladder.

Supra-pubic cystotomy	2	1	1
Litholapaxy	3	3	
Lithotomy	9	8	1
Exstrophy	2	2	
Urethral calculus	2	2	

Rectum.

	No.	Recovered.	Died.
Fistula in ano	75	73	2

Seventy-three incised; two ligatured; one died delirium tremens; one died erysipelas and abscess after elastic ligature.

	No.	Recovered.	Died.
Piles	52	51	1
Stricture	15	14	1
Tumors at margin anus	5	5	

Female Genitals.

Atresia vaginæ	2	1	1

One afterwards bore a living child and did well.

Vesico-vaginal fistula	3	3	2 cured. 1 failure.
Urethral caruncle	4	4	
Amputation cervix uteri	2	2	
Lacerated cervix	1	1	

MISCELLANEOUS.

Spina Bifida.

Aspirated and injected	1		1

Knee-Joint.

Aspiration	2	2	
Removing floating cartilage	2	2	
Old dislocated shoulder	5	5	4 reduced. 1 not reduced.
Onychia	9	9	
Neuromata	2	2	1 relieved. 1 not relieved.
Sutures, nerves, and tendons	2	2	
Excision tonsils	3	3	
Cleft palate	3	3	
Harelip	2	2	
Plastic operations	6	5	1 heart disease.
Plastic operations nose	4	4	

NERVES.

Excision of nerves	6	6	

Infra-orbital; infra-dental; three to Meckel's ganglion; one to foramen rotundum; one in infra-dental canal; one removal gasserian ganglion; one much relieved; one not relieved; "*Nevralgie epileptiforme;*" two cured; one operated on twice; one (gasserian) relieved.

GUNSHOT WOUNDS.

	No.	Recovered.	Died.
Gunshot wounds	15	12	3
Crush of muscles, thigh, incisions and drainage	1	1	
Incised wound, abdomen	2	1	1
Incised and lacerated wounds	4	4	
Wounds of joints	1	1	
Cicatrices, operated on	7	7	
Cellulitis, incisions and drainage	26	24	1*
Carbuncle, incisions and cautery	13	9	4

* One amputated.

TENOTOMY.

Talipes equino-varus	14	14	
Talipes equino-valgus	1	1	
Torticollis	2	2	
Contracted knee	1	1	
Contracted palm	1	1	
For contractions	3	3	
For fractures, tendo achilles cut	2	2	

TUMORS.

Adenomata	23	21	2
Lipomata	14	12	2
Epitheliomata	42	40	2
Sarcomata, Carcinomata, Myxomata,	48	43	5
	127	116	11
Wens	14	14	
Cysts	14	14	
Nævus	9	9	

There were two dentigerous cysts, perfectly recovered.

Total operations	1,238
Total deaths	184
Total recoveries	1,054

Mortality = .148 per cent.
Ratio of recovery = .852 per cent.

The fatal case of castration was for injury. Testis and sac excised. Constant hemorrhage, followed by sloughing and peritonitis.

FATAL CARBUNCLES.

One, two weeks' duration, on back. Crucial incision and caustic potash and styptics, as usual. Breathing difficult. Died in four days.

One of lip and cheek. Long incision, splitting lip. Also one in cheek. Deposits of hard, white purulent substance in incisions. Erysipelas of cheek. Failure. Death.

One behind left ear, seven inches by four inches; increasing. Crucial incision and caustic potash. Died, with rapid respiration and complaint of chest, in ten days.

One, eleven weeks' duration, from shoulder to loins, and into axilla; also specific eruption. Subcutaneous incisions. Died in twenty-four hours.

The results in treating cellulitis, of one death and one amputation in twenty-six cases, are worthy of notice. Only severe cases are mentioned. One-half were before the introduction of antiseptics. Free incisions; multiple incisions; *débridement;* drainage; resulted in saving limb and life.

EXCISION OF JAW.

Four fatal cases, all for malignant disease. Fourteen recoveries.

NATURE AND DURATION OF SYMPTOMS IN THE FATAL CASES OF STRANGULATED HERNIA.

One umbilical. Strangulated twenty-four hours.

Four inguinal. One strangulated twenty-seven hours. One strangulated twenty hours; died tetanus. One strangulated twenty-one hours; ecchymosis from taxis; bruised bowel; resection of intestine. One strangulated seven days; resection of bowel.

Seven femoral. One strangulated four days. One strangulated six days. One strangulated two days. One (few days), bowel black. One, now strangulated twelve hours, but down repeatedly, and intestine black. One incarcerated ten days.

LIGATURE OF ARTERIES.

	No.	Recovered.	Died.
Ligature of brachial	3	1	2
Ligature of lingual	2	2	
Common carotid	4	1	3
External carotid	1	1	
Femoral	2	1	1
External iliac	1	1	
	13	7	6

FATAL CASES.

Brachial; stab, cutting all the vessels. Ligature. Second day, hemorrhage. Amputation. Death in one week.

Brachial; pushed through a window, cutting vessels of arm. Faint and anæmic. Vessels tied. Collapse. Death, less than twenty-four hours.

Common carotid; very low down, close to innominate. For secondary hemorrhage from deep scrofulous sinuses. Died from exhaustion in five days.

Common carotid for cancer of throat and hemorrhage. Died of ascites and exhaustion in twenty-five days.

Common carotid for malignant tumor of orbit and hemorrhage; died, twelve hours.

Femoral; phlebitis and abscesses from cellulitis; three weeks; laying bare vessels. Hemorrhage. Ligature. Death from sepsis and gangrene.

Three, litholapaxy. Ages 31, 38, 60. All recovered.

Nine, lithotomy. Ages 2, $4\frac{1}{2}$, 9, 13, 17, 19, 46, 68, 72. One death, aged 19, after two months of exhaustion and phosphatic gravel. Mortality of lithotomy, 11 per cent.; ratio of recovery, 89 per cent.

FATAL CASES OF REMOVAL OF TUMORS.

One cancer, submaxillary gland. Secondary operation after epithelioma of lip. Died of erysipelas in one week.

One, cancer of orbit. Fifth operation. Eye removed six years ago. Disease again removed two years later. Third operation six months later. Fourth operation one year ago. Large growth projects from orbit. Removed.

Great hemorrhage. Left common carotid tied. Right side hemiplegia. Coma. Death in thirty-five days.

One, cancer of parotid. Secondary operation; removed a year ago. Demands operation for terrible pain. Morphine used freely. Tumor, and facial nerve to its origin, removed. Impetigo. Phlebitis. Gangrene of leg. Death fourteen days.

One, tumor of scapula. Operation. Death from shock. Before reported under "Excision scapula."

One, cancer vocal chords. Thyrotomy. Removal. Died of pneumonia in one week. Previously reported under "Thyrotomy."

One, sarcoma right cheek. Removed four years ago. Secondary operation. Tracheotomy. Throat packed. Nostrils, antrum, and cheeks filled with growth. Removed. Erysipelas. Died in one week.

One, cervical adenoma or adeno-sarcoma. Very extensive. White corpuscles increased. Long operation. Inner third clavicle removed. Subclavian vein tied. Died in thirty-six hours of shock.

One, venous erectile tumor of back and side, penetrating under scapular muscles. Also enlarged glands in axilla. Severe operation. Death in twelve days, with chills, high temperature, and gasping respiration. Sepsis.

One, cervical tumor, rapid growth. Operation. Soft and very vascular tumor. Soft cancer. Hemorrhage. Ligatures fail to hold. Packed. Swelling of neck. Restless. Collapse and immediate death on third day. No autopsy. Probably embolism.

One, cancer left carotid triangle. Interferes with respiration. Operation. Enucleated. Dyspnœa less. Temperature normal. Pulse, 110. Seemed comfortable. Suddenly sat up, and fell over dead. No autopsy. Thrombus.

The results of excision of the lower part of the rectum for cancer, in my hands, have been relief of pain to a great degree; retention of hard fæces, but not fluid; incontinence of gas; comfortable and active life for four to six months; recurrence of the disease within a year.

III.

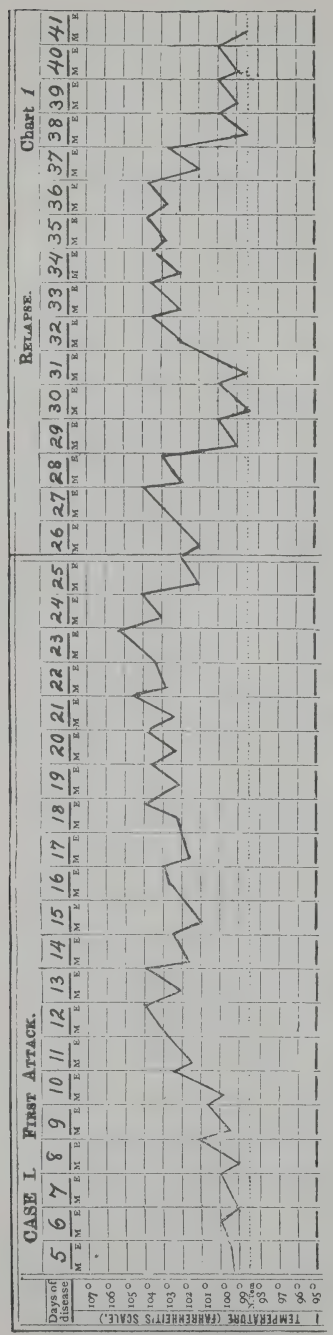
SECOND ATTACKS OF TYPHOID FEVER IN ADULTS. TWO CASES.

By A. L. Mason, M.D.

Occasionally a patient with typhoid fever says that he has had it before, but on further inquiry this statement can rarely be verified, on account of the lapse of time and memory, and the absence of accurate data regarding the previous illness, the history, charts, etc. Therefore the two following cases, which came under my care during both the primary and the second attacks, with an interval of two years in each case, are recorded as being somewhat exceptional. In Case I., that of a nurse, it seems not improbable that the disease was conveyed to her directly by the patients she was nursing.

Case I. — First Attack. Hospital nurse, aged 24, after five days of prodromal malaise, September 7, 1890, was admitted to Dr. Rotch's service with typhoid fever. She came under my care October 1, in the later stages of a typical attack, which had been characterized by much abdominal pain and tympany, and was attended by a relapse, as is shown by the appended chart. During convalescence the pulse was high, 100 to 112, and she remained in hospital sixty-five days. (See page 20, Chart 1.)

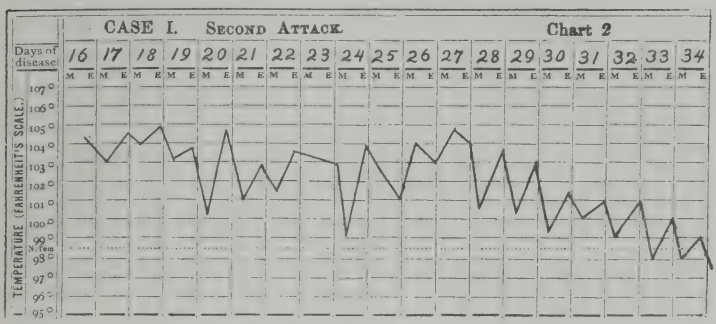
Case I. — Second Attack. October 10, 1892, the same patient was admitted to my service on the sixteenth day of her second attack. On the twenty-third of August she had gone to the country to nurse a patient with typhoid fever, and, after remaining there for a month in constant attendance, she contracted the disease herself. I saw her a few days later at home, when the symptoms were general



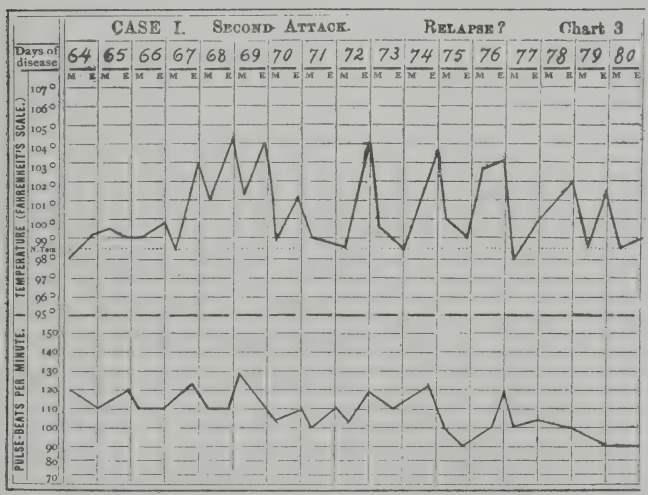
malaise, insomnia, bad headache, fever, and diarrhœa, but the knowledge of her severe attack two years before led me to doubt whether she had typhoid fever a second time. On admission to the hospital, rose-spots were abundant, the spleen was enlarged, anorexia and vomiting were troublesome. The urine was albuminous. The disease ran a longer course than before (see Chart 2, page 21), defervescence taking place at the end of the fifth week, and the pulse then falling to 80. She got up on the fifty-seventh day, but from the sixty-fourth to the seventy-ninth day convalescence was interrupted by a recurrence of febrile symptoms and severe pain in the right iliac fossa, requiring morphia for relief. (See Chart 3, page 21.) She left the hospital on the ninetieth day.

Case II. — First Attack. A male cook, aged 21, entered the service of Dr. Rotch, September 22, 1890. He had been ill ten days and complained of the usual prodromal symptoms of typhoid; malaise, pains in the limbs, headache, and nose-bleed. The bowels were constipated. In the second week splenic enlargement and rose-spots were noticeable; later the abdomen was swollen and tender. The fever abated at the end of the third week. As the patient appeared to be entering upon his convalescence, however,

a relapse occurred which delayed his recovery for another month, and he remained in the hospital until the sixty-fourth day. (See Chart 4, page 22.)

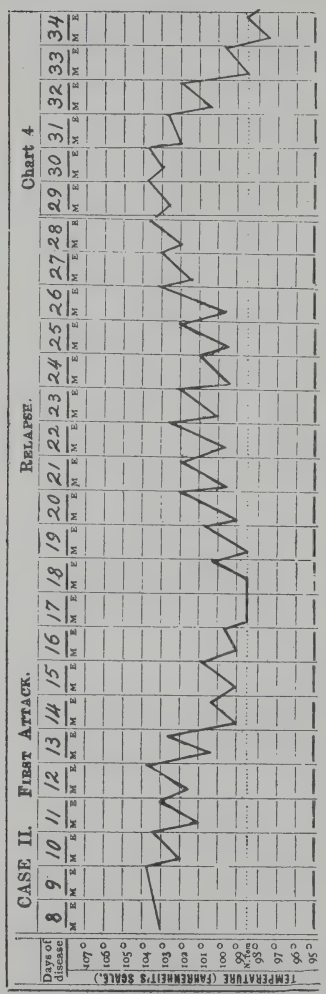


Case II. — Second Attack. March 19, 1892, the same patient reëntered my service with a history of malaise and debility for the previous three weeks. He had lost his appetite, slept badly, and felt chilly and feverish by turns.


CASE I. SECOND ATTACK. RELAPSE? Chart 3
Days of disease
64 65 66 67 68 69 70 71 72 73 74 75 76 77 78 79 80
M E
TEMPERATURE (FAHRENHEIT'S SCALE.)
107° 106° 105° 104° 103° 102° 101° 100° 99° N. Temp. 98° 97° 96° 95°
PULSE-BEATS PER MINUTE.
150 140 130 120 110 100 90 80 70

Eight days before admission he gave up and went to bed. Epistaxis had been frequent. In the second week the symptoms were bronchitis, abdominal pain, splenic enlargement, and an abundant eruption of rose-spots. Diarrhœa ensued, with tympany; epistaxis recurred, and during the third

week typhoidal stupor was very marked, as was also sensory deafness. There was no otitis. (Chart 5, page 23.) In the fourth week a laryngitis began and lasted two weeks. The right submaxillary gland became swollen to the size of a hen's egg, red and tender, but subsided without suppuration. During convalescence there was a peripheral neuritis affecting the feet and legs, and the patient was not discharged until the sixtieth day of his illness. There was no membrane in the throat at any time, and the laryngitis, glandular swelling, and neuritis were thought to be post-typhoidal.



Remarks. — The rare recurrence of typhoid fever in persons who are protected by a previous attack has been pointed out by many writers, but there is some difference of opinion as to the degree of immunity which is thus conveyed.

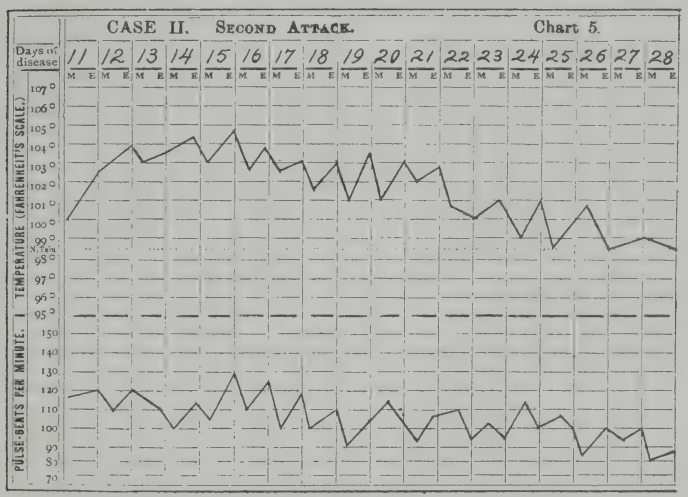
Nathan Smith, in his "Medical and Surgical Memoirs," says: "My own personal experience is strongly in favor of the non-liability of the same individual to a second attack of typhus; for during the twenty-five years since I first attended patients in this disease, and in that time I have visited many hundreds, and have witnessed its prevalence several times in the same village, I have never known nor heard of its recurrence in the same person."

This accords with the researches of Gendron in his "Mémoire sur les epidémies des petites localités."[1] He men-

[1] Journal des Connaissances Medico-Chirurgicales. Par M. Gendron. 1834.

tions several instances of this immunity, among them the following: The village of Petit-Gênes had fifteen inhabitants, of whom twelve had typhoid fever. Of the three others, two had had it before. Three years later, in a second epidemic, the disease attacked five persons only, who had come there since the previous outbreak.

Chomel, at the *Hôtel Dieu*, among one hundred and thirty


CASE II. SECOND ATTACK.
Chart 5.
Days of disease
11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28
M E
TEMPERATURE (FAHRENHEIT'S SCALE.)
PULSE-BEATS PER MINUTE.

typhoid patients, found no one who had previously had the disease.

On the other hand, Alonzo Clark, in his "Lectures on Fevers,"[1] mentions two epidemics of typhoid as occurring in Richmond, Massachusetts, in which Dr. Jennings attended two patients with second attacks, of whom he had also taken care during their fevers two years before. Sixty persons were attacked in each epidemic, but no details of these cases are given.

Piedvache[2] relates the case of a girl who had a severe attack at the age of ten, and a second one eight years later. Michel[3] had met with three cases; and Paul,[4] one in which a second attack occurred after three years.

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[1] New York Medical Record, vol. xiii. 1878.

[2] Piedvache, p. 103. 1850.

[3] Michel, p. 297. 1859.

[4] Paul. L'Union Médicale, 1870, i. 587.

Trousseau,[1] with his long hospital experience, saw but one case at the *Hôtel Dieu*, where a woman under his care had typhoid four years after an attack of the same disease in the wards of Professor Rostan, where she had remained four months. Trousseau in his private practice also met with one case: A girl twelve years old took typhoid fever in a severe form. The illness lasted fifty-seven days. In the following year she had another characteristic attack fifty days in duration.

Liebermeister[2] says that this disease confers a certain immunity, but not as complete as is the case with variola, measles, and scarlet fever. He alludes to recurrent cases at the Basle Hospital, but gives no details.

Murchison (3d edition, 1884), says: "It is generally believed that one attack of enteric fever confers an immunity from subsequent attacks." After recounting in brief the observations of Gendron, Piedvache, Bartlett, and others above-mentioned, he states that several cases had come under his notice in which two attacks had occurred in the same person after puberty, and that four similar cases were observed by Dr. William Budd (1859).

Strümpell's opinion (American edition, p. 4) is that "it does seem to be certain that the occurrence of typhoid fever gives very probable though not absolute immunity against any later new attack."

Pepper, in "The American Text-Book of Theory and Practice,"[3] states that he has attended several patients through two characteristic attacks of typhoid fever, and has had more than one apparently reliable account of three distinct attacks at intervals of several years. The same author says that a study of six hundred cases by Eichhorst showed the occurrence of a second attack twenty-eight times, or in 4.7 per cent.; and that recurrences are more common in men than in women, and milder than the original attacks.

Moore, of Dublin, in his recent work on "Eruptive and Continued Fevers,"[4] gives a "Case of Recurrent Enteric Fever followed by Relapse," in full detail, with charts of

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[1] Trousseau, vol. iii. p. 50. Sydenham translation.
[2] Ziemssen's Cyclopædia, vol. i. p. 75. [3] Vol. i. p. 105. 1893.
[4] Moore, p. 351. Wm. Wood & Co. 1892.

both attacks, and also contributes a report of the same case to the "Dublin Journal of Medical Science," April, 1892.

From the foregoing citations and cases, it appears probable that physicians who see many cases of typhoid fever may, in the course of years, meet with a few recurrent attacks in their own practice. Therefore I made inquiry on this point of most of my past and present colleagues at the City Hospital, who have all had exceptionally large experience in this disease. The mere statements of patients that they had had typhoid fever more than once were not regarded as sufficiently conclusive, but cases corroborated by records, charts, or the remembrance of professional observation, were sought for. None were found.

Dr. Robert T. Edes, who paid much attention to this disease, and whose paper on "The Cold Water Treatment of Typhoid Fever," by bathing, appeared in the City Hospital Reports, Second Series, 1877, replied to my inquiry as follows: "I do not think I ever saw a case of typhoid fever in a person who, to my knowledge, had had it some months or years before."

Dr. C. Ellery Stedman, whose published "Notes on Typhoid," based on an analysis of 1,188 cases at the City Hospital, are contained in the "Reports," Third Series, 1882, answered that he had "formed the opinion that one seldom had the fever, *really*, twice." He had no proofs of recurrent attacks, in the way of charts and records.

Dr. C. F. Folsom writes: "I have never seen recurrent typhoid fever which I knew to be such. A few patients have stated that they were suffering from second or recurrent attacks."

Dr. T. M. Rotch says: "I do not recollect any cases of recurrent typhoid."

Replies of similar tenor were received from Drs. J. G. Blake, G. B. Shattuck, E. J. Forster, and other members of the Hospital Staff with long experience. In an analysis of 676 cases of typhoid admitted to the Hospital in 1890 and 1891, after careful examination of the records, I found no recurrent cases.[1]

Therefore the two instances recorded above, with their

[1] See Boston Medical and Surgical Journal, April 7 and 14, 1892.

histories and charts, are the only ones I have been able to verify, as having occurred in this hospital, in which the same patient has been admitted twice for typhoid fever. One other case came within my own knowledge in which a recurrent attack was fatal after an interval of thirty years.

Although the negative results of such an inquiry must be to some degree inconclusive, and a few authenticated cases indicate the probability of a still greater number which fail of positive proof, I think it may be assumed that the immunity afforded by an attack of typhoid fever is as complete as in the case of the exanthemata, except, perhaps, small-pox, in which it is said that less than one per cent. of recurrences occur,[1] although Sir Thomas Watson states that a few instances are recorded of three attacks of this disease in the same person.[2]

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[1] See Reynolds' System of Medicine, vol. i. p. 139.

[2] Watson's Principles and Practice of Physic, vol. ii. p. 784, 4th edition. 1857.

CONTRIBUTIONS

FROM THE

PATHOLOGICAL DEPARTMENT

UNDER THE DIRECTION OF

DR. WM. T. COUNCILMAN.

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1. BACTERIOLOGY OF DIPHTHERIA.
2. GONORRHŒAL MYOCARDITIS.
3. MULTIPLE RUPTURE OF INTERNAL ORGANS.
4. OBSERVATIONS ON PNEUMONIA.
5. SYPHILIS OF THE HEART.
6. THE KIDNEY IN PUERPERAL ECLAMPSIA.

IV.

A BACTERIOLOGICAL STUDY OF FOUR HUNDRED CASES OF INFLAMMATION OF THE THROAT, OCCURRING IN DIPHTHERIA AND SCARLET FEVER, WITH ESPECIAL REFERENCE TO PATHOGENESIS.

By John Lovett Morse, A.M., M.D.

We owe the first description of diphtheria to Bretonneau. He regarded the presence of a pseudo-membrane in the pharynx and upper air passages as its characteristic feature. The infectious nature of the disease was first recognized in 1860 by Trousseau, who considered the local manifestations as comparatively unimportant. As the disease became more prevalent, more and more attention was directed to its clinical characteristics, and the presence of a pseudo-membrane in the throat was again regarded as its diagnostic feature. It was noted, however, that the membrane varied in different cases. In some it was removed with difficulty and left a raw, bleeding surface; in others it proved to be a mere exudation, and left an intact surface after its removal. It was also found that a fibrinous exudation, taking the form of a membrane, anatomically indistinguishable from that found in diphtheria, could be produced in a number of ways, as by wounds and irritants of various sorts. This same pseudo-membrane was also found to be produced in other portions of the body by the same irritants. A pseudo-membrane was also noted in scarlet fever, measles, and typhoid fever. The discovery of these facts resulted in great confusion, and accurate diagnosis was impossible. Every man had his own standard, and no one could prove whether he was right or wrong.

Much of the confusion arose from the fact that men failed to recognize that a diphtheritic inflammation is essentially an anatomical process and does not necessarily have any connection with the infectious disease diphtheria. Any inflammation characterized by a fibrinous exudation forming a membrane on the inflamed surface is a diphtheritic inflammation, however it may be caused. The diphtheritic membrane is due to a combination of necrosis and inflammation with fibrinous exudation. The essential factor is a necrosis of the surface epithelium. This necrotic tissue supplies the fibrin ferment, and fibrin is formed from the serous exudation which comes in contact with the necrotic tissue. The membrane itself is found on microscopical examination to consist almost entirely of fibrin and of necrotic tissue which has undergone fibrinoid metamorphosis. The tissue beneath shows evidence of the most intense inflammation. It is infiltrated with inflammatory exudation, the blood-vessels are dilated, and pus cells are found in the vessels and in the tissue. The necrosis is not limited to the surface but extends irregularly into the tissues below, often passing beneath the unchanged epithelial surface. It is here also accompanied by the formation of fibrin, the fibrin in the tissue below often connecting with that on the surface, causing this to adhere more strongly. Confusion has also arisen from the so-called diphtheroid affections of the throat. In these inflammations we may have masses of detritus, consisting of cast-off epithelium, mucus, and masses of bacteria, collected on the surface of the mucous membrane and frequently extending into the follicles. These masses can be removed in more or less adherent flakes. Under the microscope they are often found to be composed almost entirely of mucus, epithelial and pus cells, and bacteria of various forms, which evidently find a favorable culture medium in the collections of mucus and cast-off epithelium. These deposits are sometimes accompanied by marked signs of local inflammation as well as by constitutional disturbance, due to the absorption of chemical products.

The discovery of bacteria and their relation to disease, however, offered a solution for the problem. After years of careful investigation by many observers the bacillus causing

the disease was isolated and its pathognomonic character demonstrated. Klebs (1), in 1883, found that a bacillus, always the same morphologically, was constantly present in the pseudo-membrane of cases of epidemic diphtheria. Loeffler (2), in 1884, investigated the subject still further, and found that this bacillus was pathogenic in certain animals, and produced, on inoculation, a pseudo-membrane on the surface inoculated. The whole subject has been carefully gone over by numerous investigators since that time, notably Loeffler, Roux and Yersin (27), Babes (3), Welch and Abbott (4). Pseudo-membranes, paralyses, and organic lesions, similar to those in man, have been produced in animals by inoculation, and a toxine has been isolated, which produces, when inoculated, the same results as the pure culture, with the exception of the pseudo-membrane (5, 6, 7). This toxine is probably due to a ferment produced in the membranes by the bacillus, which is absorbed and forms poisonous albumins and an organic acid in the body (7, 8). Hence we now consider only those pseudo-membranous inflammations as diphtheria, in which this bacillus, known as the Klebs-Loeffler, is found. Therefore, no diagnosis can be made, which can be regarded as more than probable, without the bacteriological demonstration of this bacillus.

The Klebs-Loeffler bacillus is a small organism not much larger than the tubercle bacillus. Its most striking feature, morphologically, is its variation in form and its irregularity in staining. The ends of the organism are frequently clubbed, sometimes one and sometimes both ends, and in most cases when stained it shows a series of clear spaces along with intensely stained particles. The form and size vary greatly under various circumstances. In different cases it appears in some much larger and more irregular than in others, and in the same preparation great irregularity may be seen. It grows readily on a variety of culture media, and most readily on the modified blood serum first introduced by Loeffler. When cultivated on potato it is much larger and more irregular in form than when grown on any other medium. The organism is pathogenic for a number of animals, especially for young cats and guinea-pigs. In

guinea-pigs the most virulent form of the organism will produce death in from thirty-six to forty-eight hours. Like some other organisms, there is a marked difference in its virulence. While cultures from some cases will always produce death in thirty-six hours, in others death will not take place for several days; and in others, again, the animals may survive the primary inoculation, and afterwards die of paralysis after an interval of three or four days. Again, in still other cases, no results may follow the inoculation (9).

Numerous cases of pseudo-membranous inflammation of the throat are met with, however, which are due to other bacteria than the Klebs-Loeffler bacillus. These cases are absolutely indistinguishable clinically from those due to the action of the Klebs-Loeffler bacillus, and may be precisely the same anatomically. As a rule they are associated with streptococci, as is notably the case in scarlet fever and measles. Moreover, the Klebs-Loeffler bacillus and the streptococcus are often found together or accompanied by staphylococci and other organisms. A differential diagnosis is only possible by a careful bacteriological examination. The futility of clinical conclusions has been shown by numerous investigators. In 1889, Prudden (10) investigated twenty-four fatal cases which had been diagnosed clinically as diphtheria. In several of these cases scarlet fever and measles were also found. The Klebs-Loeffler bacillus was not found in one, but the streptococcus in all but two. Baginsky (11), in one hundred and fifty-four cases diagnosed clinically as diphtheria, found the Klebs-Loeffler bacillus absent in thirty-four. Martin (12), in two hundred suspected cases of diphtheria, found no Klebs-Loeffler bacilli in seventy-four. Park (13), in one hundred and fifty-nine cases of pseudo-membranous inflammation, found the diphtheritic bacillus in only fifty-four. In every one of the remainder streptococci were the most abundant bacteria, and often the only ones. Koplick (14) found the streptococcus alone in eleven cases of clinically pure fibrinous diphtheria. Janson (28), in one hundred cases of pseudo-membranous angina, met with the Klebs-Loeffler bacillus in only sixty-three.

As the prognosis, contagiousness, and hence the necessity for isolation, varies greatly with the form of bacteria present, the necessity of an accurate and early diagnosis is evident. This can only be obtained bacteriologically. By the examination of a cover-slip preparation, prepared directly from the throat, the presence of the diphtheritic bacillus may often be demonstrated immediately. This method is fortunately most valuable early in the disease (29) (15). The presence of the bacilli is positive evidence, their absence only negative, and in these cases further examination by means of cultures is necessary. In fact, it is advisable to examine all cases by cultures as well, which requires only twenty-four hours, for the determination of the presence of the bacteria.

The main objects of my work have been to determine by the examination of a large number of cases, in which diphtheria had been diagnosed clinically, or at least strongly suspected: (1) the proportion in which the Klebs-Loeffler bacillus was present; (2) whether or not, and if so, in what way, the prognosis was altered by its presence; (3) in what way the prognosis was altered by the presence of other organisms in combination with the Klebs-Loeffler bacillus; (4) what these organisms were and how often they were found. During the course of my investigations many other points have come up which seem worthy of special note, particularly the results bearing on the length of time which the bacillus remains in the throat and nose after convalescence is established.

The method employed has been essentially the same in all cases. Swabs are made by winding absorbent cotton tightly on the end of a piece of stiff wire five inches long. These are put in cotton-stoppered test-tubes, and sterilized by dry heat. The swab is rubbed thoroughly over the throat, and put back in the test-tube. In the laboratory the swab is carefully rubbed over the surface of a slant tube of Loeffler's blood-serum mixture. A platinum loop is run over the surface of this tube, and then smeared on a second tube; this procedure is repeated on a third tube. The cultures are left in the thermostat at a temperature of 35° C. until the next day, and then examined microscopically. The colonies on

the third tube are usually discrete enough to admit of a differential diagnosis of the organisms present. The diagnosis has been made, as a rule, on morphological appearances, although in many cases the cultural peculiarities have been investigated and animals inoculated. In one series of twenty-five cases, which will be given in detail later, the various organisms were isolated in pure cultures and accurately differentiated on the various media. The blood serum was prepared according to Loeffler's well-known formula, solidified slowly in the dry sterilizer at 75°–80° C., and then sterilized in an Arnold steam sterilizer at 100° for one-half hour on three successive days. This method is much simpler than the one in ordinary use, saves all the media, and is entirely satisfactory in every way. The organisms grow as rapidly and as vigorously as on blood serum prepared by the old method. The time and trouble saved in this way is evident. Loeffler's methylene blue solution was ordinarily employed in staining. Four hundred cases have been investigated in this routine way. All of them were examined after admission to the diphtheria ward of the City Hospital, or were cases in the scarlet-fever ward whose throats were suspicious.

These cases, as a rule, come from the tenement-house districts in the thickly populated portions of the city, the North End, about Dover street, and South Boston. A few, however, come from the outlying districts, as Brighton and Roxbury. It is safe to say that a very large portion of them live in improper hygienic surroundings, and are in poor condition to resist so severe a disease as diphtheria. Moreover, many are not brought to the Hospital until they are *in extremis*, and die within the first twenty-four hours. The proportion of adults is very small, only seventeen per cent. of the present series being over fifteen. All these factors have an important influence on the statistics, and make the percentage of mortality appear far worse than it would in other circumstances.

DIPHTHERIA, SCARLET FEVER.

The presence of the Klebs-Loeffler bacillus was demonstrated in two hundred and thirty-nine, *i.e.*, in sixty per cent. of all suspicious cases. There were three hundred and one

cases in which scarlet fever was not present, not excluding, however, those cases in which it may have occurred earlier or later. Of these, the Klebs-Loeffler bacillus was present in two hundred and seventeen, or seventy-two per cent. These results correspond pretty closely to those obtained by other investigators, Baginsky (1) having found the Klebs-Loeffler bacillus in one hundred and twenty cases out of one hundred and fifty-four, or seventy-eight per cent.; Martin (12), in one hundred and twenty-six out of two hundred, or sixty-three per cent.; Park (13), in fifty-four out of one hundred and fifty-nine, or thirty-four per cent.; and Janson (28), in sixty-three out of one hundred, or sixty-three per cent.

One hundred and thirty-six of the four hundred cases examined died, giving a general mortality of thirty-four per cent. Of the two hundred and thirty-nine cases containing the Klebs-Loeffler bacillus, ninety-nine died, *i.e.*, forty-one per cent. Of the one hundred and sixty-one in which it was not present, thirty-seven died, or twenty-three per cent. The general mortality of the three hundred and one cases not complicated with scarlet fever was thirty-six per cent. Eighty-nine of the two hundred and seventeen cases in which the Klebs-Loeffler bacillus was present died, *i.e.*, forty-one per cent.; in the eighty-four in which it was absent, twenty-one, or twenty-five per cent., died. Of the remaining ninety-nine cases in which the diagnosis of scarlet fever, or scarlet fever and diphtheria, was made, twenty-six, or twenty-six per cent., died. The Klebs-Loeffler bacillus was demonstrated in twenty-three, ten of which died, or forty-three per cent. Of the seventy-six cases in which it was absent, only sixteen, or twenty-one per cent., died.

Mortality in four hundred cases	34%
" " all cases containing K. L. . . .	41%
" " " " without K. L. . . .	23%
" " " " uncomplicated by scarlet fever,	36%
" " those cases which contained K. L. .	41%
" " " " " did not contain K. L.,	25%
" " all cases complicated by scarlet fever .	26%
" " those cases containing K. L. . .	43%
" " " " not containing K. L. . .	21%

These figures go to prove that the mortality in pseudo-membranous inflammations of the throat is nearly twice as great in those in which the Klebs-Loeffler bacillus is present as it is in those in which it is absent. Somewhat similar results have been obtained by other observers. Park (13) records a mortality of forty-six and one-half per cent. in true diphtheria. Twenty-five per cent. of Janson's (28) series in which the Klebs-Loeffler bacillus was found died, while all the other cases of angina, uncomplicated with scarlet fever, recovered. In Baginsky's (11) series thirty-eight per cent. of those with K. L. died, compared with eleven per cent. of those without. Heubner (15) found a mortality of sixty per cent. in seventy-seven cases of true diphtheria.

Of the sixty-two adults, K. L. was present in thirty-eight, absent in twenty-four. The general mortality was nine per cent.; that of those in which the Klebs-Loeffler bacillus was present, thirteen per cent.; of those in which it was absent, four per cent.

MEASLES, SCARLET FEVER.

A mild epidemic of measles occurred in the scarlet-fever ward during the course of this investigation. Six cases had measles and scarlet fever together. All recovered, and the Klebs-Loeffler baccillus was not found in any. Streptococci were present in five, staphylococci in two, and the diplococcus lanceolatus in three. Four cases of measles with severe throat symptoms, giving rise to the clinical diagnosis of diphtheria, occurred. One contained a few Klebs-Loeffler bacilli and many staphylococci, and recovered. The others were practically pure cultures of staphylococci, and all died; one, however, of scarlet fever contracted while convalescent. These cases, as far as they go, show that the Klebs-Loeffler bacillus is certainly a very rare accompaniment of the throat complications of measles. The literature on this point is very scanty. Hofmann (16) and Escherich (17) claim to have found the pseudo-diphtheritic bacillus in several cases of measles.

TYPHOID FEVER.

Four cases of typhoid fever with throat complications have been examined, and seem worthy of separate consideration.

L. F., for some time a patient on the surgical side, developed a sore throat. Bacteriological examination showed a few Klebs-Loeffler bacilli. She was transferred to the diphtheria ward, where a few days later the diagnosis of typhoid fever was made. She ultimately recovered. A guinea-pig, inoculated with a pure culture of the Klebs-Loeffler bacillus obtained from her throat, died.

K. W. entered the hospital after a sickness of a week. The diagnosis of typhoid was made, but she was put in the diphtheria ward because of her throat. Examination showed a few Klebs-Loeffler bacilli, many staphylococci, and a few streptococci. Her throat was clear in five days, and she was soon after transferred to a medical ward, where she recovered.

F. D. was ill with typhoid in a private room. A nurse, several days after leaving the scarlet-fever ward, had a sore throat, and was put in the same room overnight. On the discovery of the Klebs-Loeffler bacillus on the next day she was transferred to the diphtheria ward. Four days later F. D. developed a sore throat with membrane. The presence of the Klebs-Loeffler bacillus was demonstrated, and she was also transferred. The next day a typical scarlet-fever rash developed, which was followed by desquamation. Her throat was clean in ten days, and she ultimately recovered.

Isabella N., 19, was admitted to the medical wards of the Boston City Hospital on October 27, at about the middle of the first week of typhoid. She was a large, well-built girl, in very good condition. A faint systolic murmur was noted in the heart at both base and apex. Although her temperature ranged high, she did very well until November 4, when she became delirious and her pulse more frequent. She slowly lost ground, and on November 11 it was noticed that swallowing was painful. Examination of the throat showed both tonsils and pillars of fauces covered with a dirty-white membrane, which extended all over adjoining parts of soft palate and uvula. The posterior pharyngeal wall was not seen. She was immediately transferred to the diphtheria ward. Cultures from swabs made on this day and the next showed streptococci and staphylococci, but no diphtheria bacilli. Blood serum tubes made from swabs of November

14 showed almost pure cultures of the Klebs-Loeffler bacillus. She was able to take but little nourishment, and remained semi-unconscious and delirious. Her pulse gradually failed, and she died on November 17. Her throat had begun to clear up during the last two days. The autopsy was performed by Dr. Councilman thirty hours after death.

Body. — Large, well-built, tolerably well-nourished.

Skin. — Generally pale and anæmic. Mucous membranes pale. Posterior surface of body slightly congested. No eruption. Subcutaneous fat medium in amount.

Abdomen. — Moist, and peritoneum smooth, save over spleen, where there is a slight fibrinous exudation. Both liver and spleen free from connective tissue adhesions. Along course of ileum and colon areas of congestion. Diaphragm in usual position. Anterior mediastinal glands slightly enlarged and reddened.

Lungs. — Remarkably free from pigment. Both slightly adherent by old adhesions. The entire posterior part of right lung congested, œdematous, and slightly consolidated, the consolidation generally lax, with here and there areas of more distinct consolidation about the bronchi. The entire pleural surface of this portion of the lung covered with a slight fibrinous exudation, more marked between the lobes. The parietal pleura congested. Abundant muco-purulent secretion from the bronchi everywhere in the lungs, particularly in the posterior parts. In the left lung there are a few areas of consolidation about the bronchi, but the consolidation is everywhere less well-marked than in the right. The bronchial glands distinctly enlarged, reddened, and slightly pigmented.

Heart. — Medium size. Both layers of pericardium smooth. The myocardium generally pale, without any appearance of faded leaf. In the right ventricle there are fresh clots. In the left, there are old thrombi covered with adherent fresh clots along the musculæ trabeculæ of the septum and the apex of the ventricle.

Liver. — Large. Surface pale, markings somewhat obscure. Gall-bladder distended, bile-ducts free. On section, liver pale and somewhat cloudy.

Spleen. — Seventeen by ten by five centimetres. Weight three hundred and forty grams. Surface covered with a slight fibrinous exudation. On section, comparatively firm, homogeneous, of a dark-red color with small dark-red points of hemorrhage scattered through it. Neither Malpighian bodies nor trabeculæ visible.

Kidneys. — Of ordinary size. Surface smooth and capsule not adherent. The lobules very evident. On section, cortex pale, markings faintly visible, the labyrinth cloudy. On the surface of the right kidney there is a slightly elevated, soft, nodular mass one and a half centimetres in diameter. On section the cortex at this point is soft, pale, with opaque white streaks and points scattered through it; where it extends into the pyramid, it has a reddish color.

Mesenteric Glands. — Both of the mesentery and mesocolon are enlarged, deeply injected, and soft. The postmesenteric are also enlarged and reddened.

Intestines. — In the intestines there are numerous ulcers. There is one low down, almost in the rectum. Throughout the large intestine there are numerous ulcers with sharply circumscribed edges and perfectly clean base, extending down to the muscular coat, one of them extending through this to the peritoneum. In the small intestine also there are ulcers of the same general character as those in the large. Higher up in the intestine are some with sloughs in the base.

Adrenal Glands and Pancreas. — Normal. The pancreas large and firm.

Pharynx and Larynx. — Mucous membrane of the pharynx covered with an extensive muco-purulent mass. The tonsil on left somewhat enlarged and covered with a whitish deposit, which is easily scraped away, but does not wash off. On removal of this there is an epithelial loss of substance. There is an extensive formation of the same substance on the lateral wall of the pharynx opposite to the larynx. In the larynx there is an irregular ulcer on each side along the posterior portion of the vocal cord. The edges of the ulcer have a grayish film over them; the base also. All of the cervical glands are enlarged, softened, and reddened. The trachea is intensely congested.

ANATOMICAL DIAGNOSIS.

Typhoid fever. — Ulceration of ileum and colon.

Diphtheria.

Heart thrombus.

Renal Infarction.

Conjestion, œdema, pneumonia, and bronchitis in the lungs.

Acute swelling of spleen.

Diphtheritic ulceration of larynx.

Diphtheritic pseudo-membranous inflammation of pharynx.

Hyperplasia of lymphatic glands.

Acute parenchymatous degeneration of liver, kidneys, and heart.

BACTERIOLOGICAL EXAMINATION.

Lung. — Pure culture streptococci.

Tonsil. — Numerous streptococci and other cocci, with a few Klebs-Loeffler bacilli.

Trachea. — Mainly streptococci and Klebs-Loeffler bacilli.

Tracheal gland. — Negative.

Bile. — Typhoid bacilli.

Spleen. — Typhoid bacilli.

Mesenteric Glands. — Bacillus coli communis.

Pleura. — Streptococci.

Bronchial Glands. — Streptococci.

Heart's Blood. — Negative.

Heart's Thrombi. — Typhoid bacillus; streptococci.

Kidney Infarction. — Typhoid bacilli; streptococci.

Kidney. — Typhoid bacilli; streptococci.

Liver. — Streptococci.

One of the two pigs inoculated with the pure culture of the Klebs-Loeffler bacillus, obtained from the trachea, died in forty-eight hours with the pathological lesions of experimental diphtheria. The bacilli, however, were not found at the seat of inoculation. As far as I know, this is the first reported autopsy of a mixed case of typhoid and diphtheria. It proves conclusively that certain of the inflammations of the throat occurring in typhoid may be due to a mixed infection with the Klebs-Loeffler bacillus. The other cases

cannot be considered as more than suggestive. Wagner, who has given the most accurate description of the angina accompanying typhoid fever, calls attention to the greater frequency of pseudo-membranous affections when diphtheria is prevalent.

The bacteriological examination of the tissues of the case show that three different infections have taken place. One by means of the typhoid bacillus; one by means of the Klebs-Loeffler; and one by a streptococcus, which probably found its point of entrance in the tissues from the lesions in the throat. Evidences of these three different infections were present in the tissues. The general lymphatic hyperplasia was due both to the typhoid and diphtheria. The lesions in the lung and pleura were due to streptococci coming from the throat, and from here the general infection of the body may have taken place. Streptococci were found in the thrombus in the left side of the heart, and on section of the tissue beneath the thrombus there was a slight endocarditis with streptococci in the superficial layers of the tissue. The embolus which produced the infection of the kidney came from the heart thrombus, and produced a circumscribed purulent infiltration of the kidney in the place of a simple infarction. No effect seems to have been produced on the intestinal ulcers by the other infections. They had the typical appearance of late ulcers in the beginning of healing. The presence of the streptococci in the acute fibrinous pleurisy shows that they may produce in the pleura as typical a fibrinous exudation as is found in the pleurisy accompanying an acute croupous pneumonia.

MIXED INFECTIONS.

The pseudo-membranous inflammations of the throat occurring in scarlet fever are always accompanied by cocci, usually streptococci. The presence of the Klebs-Loeffler bacillus means association with diphtheria as the result of a mixed infection. Janson (28) in seventeen cases of scarlet fever found streptococci alone or associated with other cocci. Baginsky (11) did not find the Klebs-Loeffler bacillus in scarlet fever, and thinks that it disappears in cases of diphtheria when an eruption similar to the scarlatinal fever is

developed and gives place to cocci. Park (13) found streptococci in seventeen cases of scarlet fever, and Sorenson (18) in thirteen cases of scarlatinal diphtheria found cocci and other organisms, but never Klebs-Loeffler bacillus. Booker (19) has made a special study of the forms of cocci found in the scarlatinal pseudo-membranous angina, but does not find the Klebs-Loeffler bacillus in them. Escherich and Bourges, however, have found them in the throat affections appearing in the course of scarlet fever.

In ninety-nine cases of scarlet fever with simultaneous pseudo-membranous inflammation of the throat, the following bacteria were found:

Klebs-Loeffler bacilli alone . .	3
K. L. and streptococci . . .	1
K. L. and staphylococci . . .	10
K. L. and streptococci and staphylococci	9
Streptococci alone	4
Staphylococci alone	12
Streptococci and staphylococci . .	23
Streptococci, stapylococci, and others .	34
Other bacteria	3

That is, there were twenty-three cases of mixed infection, or nearly twenty-five per cent. Streptococci were present, alone or associated, in seventy-one cases, or in seventy-one per cent.

This tremendous proportion of cases of mixed infection can be accounted for in a number of ways. In the first place, the scarlet-fever and diphtheria wards, although isolated from the rest of the hospital, are in charge of the same house-officers and visiting physicians. They are constantly going from one ward to another, and, although always wearing gowns in the wards and disinfecting their hands on leaving a ward, are probably responsible for a large number of the mixed forms. Various other persons, not directly connected with the care of the patients, also enter both wards. The possibility of the direct infection with Klebs-Loeffler bacillus by physicians, nurses, and convalescent

patients must also be considered, as it is undoubtedly a fact that a person with a very slight sore throat, without visible membrane, due nevertheless to the Klebs-Loeffler bacillus, may infect others with a severe form of the disease. It is also a fact that the bacillus remains for a long time in the throats of convalescent patients, retaining its virulence, and rendering them a source of danger to others. Escherich (17) found the virulent diphtheria bacilli in cases in which the clinical picture of diphtheria was wanting. He thinks that these persons are immune towards the toxine, while there is no limitation to the growth of the bacillus. In one case a nurse in a hospital had the bacilli in her throat, and, without being diseased herself, gave the disease to the children intrusted to her care. Feer (20) reports five cases in children in which the diphtheria bacilli were found on the tonsils without there being a trace of membrane. Koplick (14) has also proven the existence of similar cases. A certain number enter the Hospital with a mixed infection, as is shown by bacteriological examination. As there is at present no separate ward for such cases, they are necessarily placed in one of the present wards. Although they are isolated as far as possible in separate rooms, they are undoubtedly the source of a certain number of other mixed cases. I think, moreover, that the diagnosis of scarlet fever is often made on insufficient grounds. The existence of scarlatiniform rashes and erythema fugax in diphtheria is well recognized (21 and 22). Steam and rough clothing next to the skin are also very likely to cause an erythema, which is often quite lasting. Drug exanthems may also give rise to error. These mistakes in diagnosis are especially liable to occur in cases which survive but a short time, thus not allowing opportunity for the recognition of the fleeting nature of the eruption. That these mixed cases do originate in the Hospital is shown by the fact that during the period covered by this study sixteen cases developed scarlet fever in the Hospital at an average time of nearly two weeks after entrance. Moreover, seven cases of scarlet fever developed inflamed throats during convalescence, in all of which the Klebs-Loeffler bacilli were then demonstrated, although they had been absent previously. Under the present condi-

tions these secondary infections are unavoidable, although every possible precaution is taken to prevent them. With the completion of the new wards for contagious diseases, however, which are now in process of erection, the conditions will be radically improved and all opportunity for such cases removed.

BACTERIA OF THE HUMAN MOUTH.

Very extended researches (34) have been made with reference to the bacteria in the human mouth, which show that numerous species are constantly present in the buccal secretions and upon the surface of the moist mucous membrane. Some are occasional and accidental, while others appear to have their normal habitat in the mouth, where the conditions as to warmth, moisture, and organic matter are extremely favorable for their development. Up to the year 1885 Professor Miller, of Berlin, had isolated twenty-two different species from the human mouth; ten were cocci, five short bacilli, six long bacilli, and one a spirillum. He later cultivated eight additional species. Vignal has isolated and described seventeen species obtained by him in pure culture from the healthy human mouth; most of them are bacilli. Miller, who found micrococci to be the more numerous, supposes the difference in results to be due to the fact that many of the cocci do not grow on nutrient gelatine, which was the medium employed by Vignal.

Among the species we find two of the most common pus cocci; viz., the staphylococcus albus and aureus. Very different results have been reported by different observers as to the frequency with which these pathogenic cocci are found in the buccal cavity. Black, in the saliva of ten healthy individuals, found the staphylococcus pyogenes aureus seven times, the staphylococcus albus four times, and the streptococcus pyogenes three times. On the other hand, Netter found the staphylococcus aureus only seven times out of one hundred and twenty-seven persons examined. Vignal, in the course of his researches, did not find the streptococcus pyogenes at all. Experiments made by Sternberg, Vulpian, Fraenkel, Netter, and others, show that the diplococcus pneumoniæ is frequently present in the

mouths of healthy individuals. Netter found it in fifteen per cent. of one hundred and sixty-five cases. Several other species have also been isolated by late observers. Sanarelli has also shown that the normal saliva has the power to destroy the vitality of a limited number of certain pathogenic bacteria, among them the staphylococcus aureus and streptococcus pyogenes.

RELATIVE FREQUENCY OF MICRO-ORGANISMS.

The small number of organisms found in the course of this study is probably because many do not grow on the media employed, and because others do not develop in the short time allowed before the cultures are examined.

The organisms most commonly met with, either alone or associated with the Klebs-Loeffler bacilli, were streptococci and staphylococci. Diplococci were found in a number of cases and various forms of bacilli met with from time to time.

Streptococci occurred in 191 cases, or 48%.
Staphylococci occurred in 295 cases, or 74%.
Diplococci occurred in 54 cases, or 13%.
Bacilli occurred in 87 cases, or 22%.

MORTALITY.

In this routine work no attempt was made to determine the nature of these bacilli, although several of them were carefully worked out in a shorter series to be reported later. The diplococcus lanceolatus was also noted in nine cases. As has already been stated, the mortality in cases containing the Klebs-Loeffler bacillus was forty-one per cent. against twenty-three per cent. in cases in which it was absent. How the mortality was influenced by the presence or association of the various bacteria is shown in the following table:

K. L. alone in 46, of which 20 died, 43%.
K. L. with streptococci in 21, of which 6 died, 28%.
K. L. with staphylococci in 93, of which 43 died, 46%.
K. L. with streptococci and staphylococci in 77, of which 29 died, 38%.
K. L. with others in 3, of which 1 died, 33%.

Streptococci alone in 19, of which 1 died, 5%.
Staphylococci alone in 37, of which 15 died, 40%.
Staphylococci and streptococci 99, of which 19 died, 19%.
Others in 5, of which 2 died, 40%.

These figures show that the mortality is about twice as great in those pseudo-membranous inflammations of the throat in which the Klebs-Loeffler bacillus is present as in those in which it is absent. They also show that the mortality is not appreciably altered by the presence of other bacteria in association with the diphtheria bacillus. This result is somewhat at variance with those obtained by other investigators, several of whom have done special work with regard to the influence of other bacteria on the virulence of the Klebs-Loeffler bacillus. Roux and Yersin (27) made injection experiments on guinea-pigs with mixed cultures of Loeffler's bacillus and erysipelas. The animals experimented on died in forty-eight hours, while other guinea-pigs, which were inoculated with pure cultures of the same diphtheria bacillus, did not die. They also found certain products in mixed cultures which were not present in the pure cultures of either organism.

The toxic albumens obtained from the mixed cultures were much more virulent than those from the pure. Those of pure cultures of diphtheria bacilli killed guinea-pigs in thirty-six hours, while those from mixed cultures killed them in ten hours. Janson (28) thinks that the prognosis is worse when the bacilli are associated with a streptococcus. Heubner (15) found that 66% of the cases in which the bacilli were found alone died, and 55% of those in which they were associated with other cocci. Martin (23) found that in all cases of diphtheria where the streptococci were present there was a more fatal course than in those where only simple forms of cocci were found. He thinks that the presence of streptococci, either with or without the bacillus, materially complicates the prognosis. Goldscheider (24) found that the cases in which streptococci were present ran a more severe course, and lasted longer, and thinks that they may play a very important role in diphtheria. Gottstein (25) thinks that the streptococcus symbiosis may cause an

increase in the virulence of the bacilli. Barbier (26) thinks that the diphtheritic infection may have a much more malignant character when it is engrafted on a streptococcus inflammation. He is inclined to believe that there are two forms of diphtheria to be separated from one another, — one the pure form, and the other mixed with streptococcus. The latter corresponds to the form known as septic diphtheria. The general opinion thus seems to be that other organisms, especially streptococci, in connection with the Klebs-Loeffler bacillus, render the prognosis more grave. It would seem from my figures, however, that they have little or no influence. It would also seem that staphylococci, either alone or in combination, were more fatal than streptococci.

A series of twenty-five cases, uncomplicated by scarlet fever, and containing the Klebs-Loeffler bacillus, were examined more carefully. Agar plates were made from the first slant tube of blood serum, and all the organisms present isolated in pure cultures. Pure cultures of all the Klebs-Loeffler bacilli were obtained upon blood serum, of the streptococci on glycerine agar, and of the staphylococci on blood serum or agar. The staphylococci were also further differentiated by growth and liquefaction in gelatine stick cultures. The other organisms met with were studied as to their cultural peculiarities on the various media and inoculated into animals. The following table shows the results obtained:

No.	Name.	Diag.	Bacteria.	Result.
1	M. B.	D.	K. L. Streptococci.	D.
2	B. C.	D.	K. L. Streptococci: Staphylococcus Albus.	D.
3	D. F.	D.	K. L. Streptococci: Staphylococcus Aureus.	W.
4	F. K.	D.	K. L. Streptococci.	D.
5	A. O.	D.	K. L. Staphylococcus Albus.	W.
6	C. K.	D.	K. L. Streptococci.	W.
7	S. G.	D.	K. L. Streptococci: Staphylococcus Albus. Staphylococcus Aureus.	D.
8	S. M.	D.	K. L. Streptococci.	W.
9	M. D.	D.	K. L. Streptococci.	D.
10	F. R.	D.	K. L. Bacillus Coli Communis (1).	D.
11	F. H.	D.	K. L. Streptococci: Staphylococcus Aureus.	D.
12	S. R.	D.	K. L. Streptococci.	W.
13	W. M.	D.	K. L. Streptococci: Diplo-Bacillus (2).	D.
14	V. E.	D.	K. L. Streptococci.	W.
15	A. A.	D.	K. L. Streptococci: Staphylococcus Aureus.	W.

16	E. W.	D.	K. L. Streptococci.	W.
17	O. T.	D.	K. L. Staphylococcus Albus.	D.
18	F. H.	D.	K. L. Staphylococcus Aureus.	D.
19	J. H.	D.	K. L. Streptococci.	W.
20	V. P.	D.	K. L. Large Diplococcus (3).	W.
21	L. R.	D.	K. L. Streptococci. Large Diplococcus (3).	D.
22	E. M.	D.	K. L. Streptococci. Diplo-Bacillus.	D.
23	G. T.	D.	K. L. Streptococci. Short Bacillus (4).	W.
24	T. K.	D.	K. L. Streptococci: Staphylococcus Aureus.	D.
25	B. H.	D.	K. L. Staphylococcus Albus. Staphylococcus Aureus.	D.

(1.) Bacillus Coli Communis.

Diagnosis made on following peculiarities: Short, thick bacillus with rounded ends, often resembling a coccus. Acidified and coagulated litmus milk. Formed gas in sugar agar. Did not liquefy gelatine. Gave moist, distinct, yellowish growth on potato. Slightly motile in hanging drop of bouillon culture. Gave indol reaction in Dunham's solution.

(2.) Diplo-Bacillus.

A diplo-bacillus with lancet-shaped ends. Morphologically always the same. Stains readily with the aniline dyes. Grows freely in white colonies on blood serum and glycerine agar. No growth in gelatine. Invisible growth on potato. Does not form gas in sugar agar. Does not coagulate or acidulate litmus milk. Whitish growth at bottom of bouillon. Non-motile in hanging drop of bouillon culture. Non-pathogenic for guinea-pigs. Resembles more nearly the bacillus septicus acuminatus of Babes than any other, but is probably not the same. Was found in two cases of this short series and observed a good many times in the long series, although its cultural characteristics were not studied at that time.

(3.) Large Diplococcus.

Colonies on agar plates, white, homogeneously granular, with well-defined edges. Grows rapidly. Profuse white growth on glycerine agar; removed from surface with difficulty. Grows freely on blood serum. No growth in gelatine. Slow growth at bottom of bouillon. Non-motile in hanging drop of bouillon culture. No growth on potato. Non-pathogenic for guinea-pigs.

(4.) Short Bacillus.

A small bacillus, not forming spores. Stains with aniline colors. On gelatine plates deep colonies show coarsely granular, sharply defined centre with finely granular, outer layer having well-defined border. Liquefy plates in 24°–48°. Stick cultures in gelatine tubes show profuse white growth, liquefying surface and extending in pyramidal shape downward. Profuse growth on blood serum which it liquefies. Moist, yellowish growth on potato. Profuse white growth on surface of sugar agar, but no gas formation in stick culture. Gives marked white cloudiness in bouillon culture, and after a few days forms a white pellicle on surface. Motile in hanging drop of bouillon culture. Does not coagulate or acidify litmus milk. Profuse creamy-colored growth on glycerine agar. Non-pathogenic for guinea-pigs.

These two last forms do not correspond to any described by Sternberg. This may be either because they have not been met with before, or if so, imperfectly described.

Of course, statistics compiled from so small a number of cases are of little value, but I nevertheless give them for what they are worth.

Klebs-Loeffler bacillus not found alone.

Streptococci in 19, or 76%.

Staphylococci in 10, or 40%.

K. L. and streptococci in 9, or 36%.

K. L. and staphylococci in 4, or 16%.

K. L., streptococci and staphylococci in 6, or 24%.

General mortality, 56%.

Mortality, K. L., with streptococci alone, 33%.

Mortality, K. L., with staphylococci alone, 66%.

Mortality, K. L., with streptococci and staphylococci, 66%.

Thus this series, as far as it goes, also seems to prove that staphylococci are more fatal in combination with the Klebs-Loeffler bacilli than streptococci. It must be remembered, however, that in both series bacteriological results have alone been considered. It is very probable that an explanation for this excessive mortality in connection with the staphylococci would be found in the other pathological conditions, other factors, possibly severe lung complications, being present to account for the fatal termination.

Streptococci were present in a much larger proportion of

cases than in the longer series. This result is, however, probably more correct, for in the routine examination mistakes were liable to arise in two ways. Streptococci, on account of their slower and smaller growth, were probably missed in some cases, and in others called staphylococci because they were bunched, it often being impossible to differentiate the two forms when closely crowded on a cover-slip.

VIABILITY OF KLEBS–LOEFFLER BACILLUS. — PERIOD OF CONTAGIOUSNESS.

At the suggestion of Dr. G. H. M. Rowe, Superintendent of the Boston City Hospital, investigations were begun as to the length of time that the Klebs-Loeffler bacilli remained in the throat after it was apparently clean. By his direction, also, patients are now not allowed to leave the Hospital until the bacilli have disappeared from both throat and nose, as shown by bacteriological examination. The results of the examinations in the first twenty-five cases are appended. Considerable work has recently been done in this direction by various men. Janson (28) found the bacilli fourteen days, and Heubner (15) ten days after the membrane had disappeared from the throat. Tobiesen (30) examined the throats of forty-six patients, who left the hospital as well, for diphtheria bacilli. They were found in twenty-four cases, the length of time which they persisted bearing no relation to the previous severity of the case. They were found eight times four days after the membrane had vanished; three times, five days after; three times, seven days after; three, nine days after; one, eleven days after; one, fourteen days after; one, fifteen days after; one, seventeen days after; and one, thirty-one days after. These patients did not present any other pathological condition. He thinks that the presence of bacilli in the pharynx is assisted by pathological conditions of the larynx and nose. This late bacillus had the same pathogenic influence, on the inoculation of guinea-pigs, as the others. He regards it as possible that half the patients who leave a hospital, after having had diphtheria, have the power to infect their surroundings with the disease. He found one case who, after

leaving the hospital, was certainly the source of infection for others. Loeffler (31) investigated one case daily as to the presence of diphtheria bacilli. The fever disappeared on the fifth day, and the throat lesions on the sixteenth day. The bacilli, however, remained for four weeks longer. Verstraeten (32) also found the bacilli four weeks after the membrane had disappeared, and Roux and Yersin (27) found them in virulent condition fourteen days after the membrane had vanished.

In my cases it was found that the average length of time that the Klebs-Loeffler bacillus remained in the throat or nose after the membrane had disappeared was ten days. The average duration was the same for both throat and nose, although in some cases the bacilli were found in the throat much longer than in the nose, and *vice versa*. The bacilli disappeared in one case the day after the throat was clear; in three, three days after; and in one, four days after. In two cases in which the bacilli were never found in the nose, they remained in the throat ten and seventeen days respectively. In other cases, they were present in the throat thirty-seven days, and in the nose thirty-six days; in the throat twenty-two days, and nose eighteen days; in throat ten days, and nose seventeen days; and in both twenty-seven days. In order to test the virulence of these late bacilli, a guinea-pig was inoculated with a pure culture of the bacillus obtained from a throat which had been perfectly clear for ten days. It died on the third day, and the Klebs-Loeffler bacillus was recovered from the seat of inoculation.

PSEUDO–DIPHTHERITIC BACILLUS.

The so-called pseudo-diphtheritic bacillus was not considered in this series, as the diagnosis was usually made entirely on morphology, and the cultural and pathogenic properties of the bacilli rarely studied. So much has been written about this organism, however, that it deserves consideration. The evidence is very contradictory, however, and the question of its existence must still be regarded as unsettled. Hofmann (16) finds that this bacillus is a frequent and apparently regular inhabitant of the pharynx, and that it agrees very closely in its morphology and physiology with the

Klebs-Loeffler bacillus, but is non-virulent. He says that certain definite morphological differences may be made out on careful comparison with the Klebs-Loeffler bacillus, but fails to state them clearly. Escherich (17) thinks that the diphtheritic bacillus has in bouillon cultures a greater tendency to arrange itself in parallel masses, while the pseudo-bacilli lie in irregular groups. In the pseudo-bacillus there is a brown color on old agar cultures which never occurs on diphtheria cultures. He regards as the most distinctive point the growth in litmus bouillon, which at first remains violet and then becomes red. Diphtheria cultures at once produce this. By inoculations of guinea-pigs no immunity could be produced. According to his investigations the pseudo-bacillus has been found only thirteen times in three hundred and twenty cases. Fraenkel (33) thinks that it is the true bacillus which loses its virulence on artificial media just as the pneumococcus does. Roux and Fraenkel consider the two bacilli identical, and that the only difference is one of virulence. Roux and Yersin (27) found that the only difference between these forms appears to be that the pseudo form is found shorter on serum, that it develops more abundantly in bouillon, and continues to grow at twenty to twenty-two, while the virulent form grows only slowly. The change in the reaction of the bouillon takes place less quickly in the pseudo-diphtheritic than in the diphtheritic. They sought for this pseudo form in forty-five sound children and found it in fifteen. They also found it in the throats of twenty-six children out of fifty-nine in a village where there was no diphtheria. It was always present in small numbers. The inoculation of this bacillus never produced fatal consequences; at the most only a local œdema. They succeeded in various ways in diminishing the virulence of cultures of the virulent bacilli. The non-virulent organism thus produced compared fully with the pseudo-diphtheritic bacillus. These pseudo and non-virulent forms did not produce any toxines. In some cases, also, it was possible to increase the virulence of the organisms. The virulence was increased when the guinea-pig was inoculated with an active erysipelas culture at the same time. Neither the weakened bacillus nor the streptococcus alone could produce

the death of the animal, but the mixed cultures could. Death took place with the phenomena of diphtheria, and the diphtheritic bacilli underwent an increase of virulence. The weight of evidence at present thus seems to show that the organisms are the same, differing only in virulence. Further work is necessary, however, before the question can be definitely settled.

RESULTS.

The results obtained from the study of this large number of cases are not as valuable as they would be if the clinical side was considered in connection with the bacteriological. It is probable, for example, that the mortality apparently due to staphylococci would be to a certain extent explained by a careful examination of the cases clinically. The relation of the operative cases to the bacteria present is also important. There would be great danger, however, of detracting from the value of the results as a whole if too many factors were considered. It is unfortunate also that the fatal cases could not have been autopsied, as an accurate knowledge of the pathological and bacteriological conditions would be invaluable. It is extremely difficult, however, to obtain autopsies in Boston, and in no case more so than in that of a contagious disease. It is to be hoped, nevertheless, that they may be obtained in the future and this vast amount of material utilized, for here lies the field for conclusively demonstrating the results of the symbiosis of other forms of bacteria with the Klebs-Loeffler bacillus.

In closing, I wish to thank the Visiting Staff and Superintendent of the Boston City Hospital for the opportunity to use the material there, and Dr. W. T. Councilman for advice and instruction in my work.

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V.

GONORRHŒAL MYOCARDITIS.

By W. T. Councilman, M.D.

In spite of the fact that gonorrhœa is one of the most common diseases, our knowledge of the pathological lesions is obscure. This is due to the fact that the disease is not open to experimental investigation, and acute cases rarely come to autopsy. We know but little of the exact character of the lesions in the mucous membrane of the urethra, and the secondary lesions are still more obscure. It will not be worth while to go over the general literature with regard to the part which the organisms described by Neisser in 1881 play in the process. Since Neisser's description of the organism, our knowledge concerning it can be briefly stated as follows: It is agreed by all, or nearly all, who have studied the disease, that the gonococcus is found in the discharge from the urethra in all cases of acute gonorrhœa. The organism is characterized by morphological, staining, and cultural properties. It is easily recognized, being stained by most of the aniline colors. It is a micrococcus, and is always found in pairs or in tetrads. The single organisms are not perfectly round, but have more or less of a biscuit shape, the adjoining sides of each pair being flattened. It often presents a rather peculiar appearance in the pus cells, being crowded in one side of the cell, and pushing the nucleus before it. The nucleus of the cell is never invaded. Unlike all of the pus organisms, it is decolorized by the solution of iodine used with the Gram stain. It also differs from the pus organisms in its cultural properties. It will not grow on the ordinary culture media, and so far it has

only been possible to cultivate it on solidified human-blood serum or on a mixture of this with agar-agar.

The organism has only been cultivated by a few observers, and its cultivation is apparently attended with great difficulties. The first successful cultivation, and the first exact study of the inflammations caused by inoculating the organism, were made by Bumm. Bumm succeeded in growing it on human-blood serum which he obtained from placentas. His studies of its pathogenesis were made on the conjunctiva, where he succeeded in producing a typical gonorrhœal inflammation by inoculating the mucous membrane with pure cultures of the fourth and fifth generations. According to Bumm, the action of the organism is essentially superficial; he found that when the conjunctiva was inoculated with a pure culture of the organism, the first action was to produce an increase in the conjunctival secretion, then the organism entered into the superficial layers of the epithelium. They were generally found between the epithelial cells, and occasionally in the papillary bodies. On the second day after the inoculation there was a marked emigration of leucocytes from the vessels beneath. Some of the leucocytes entered into the epithelium along with the cocci, pressing aside the cellular elements. When the epithelium is destroyed, a layer of fibrino-purulent exudation is found which contains masses of the organisms. The organisms do not enter into the connective tissue. Bumm found that the epithelium of the cornea is not invaded by the organism, which appears only to exert its action on cylindrical epithelium or on epithelium closely related to this. Bumm found that the gonococcus does not grow in the mucous membrane of the vagina, and gonorrhœa in the female is an affection either of the urethra or of the cervix uteri.

Bokhardt claims to have cultivated the organism, and studied the result of its inoculation into the urethra. He injected into the healthy urethra of a man forty-five years old what he supposed was a pure culture of gonococci, and obtained a characteristic discharge with a secretion containing a number of the organisms. The man was affected with an incurable nervous disorder. He died ten days after the injection from a hypostatic pneumonia. At the autopsy an

intense acute inflammation of the urethra, of the bladder, and of the pelvis of the kidney was found. In the sections made of the tissues Bokhardt obtained the organisms. No one on carefully reading the article of Bokhardt can fail to be convinced that the disease which he produced in the man was not gonorrhœa, but a purulent infection. It is more than probable that the organisms in his culture were not gonococci, but some one of the pus organisms. They were grown on agar-agar, and all of the evidences which we have on the subject show that the gonococci do not grow on this medium. Bokhardt's description of the pathological process in the urethra differs materially from that described by Bumm in the conjunctiva. Bokhardt obtained the organisms from the epithelium and in the subcutaneous tissue of the urethra. In the deeper tissues they were found chiefly in the lymphatics, which were often completely plugged with them. The illustrations which accompany the article of Bokhardt show that the supposed organisms which he found in the deeper layer of the tissues were not gonococci or any other organisms, but probably the granular plasma cells.

Although the pathology of chronic gonorrhœa in the urethra and the lesions following this have been carefully worked out by Finger and others, we have not been able to find in the literature a single case, with the exception of the case of Bokhardt which we have referred to, in which the lesions in acute gonorrhœal urethritis and the part which the gonococcus plays in their production have been studied.

The secondary infections following gonorrhœa have been more carefully investigated. These secondary infections may be briefly stated to consist in purulent inflammation of the canals and passages, in both male and female, connected with the urethra or vagina, acute swelling of the inguinal glands, acute inflammation of the joints and synovial surfaces, and pericarditis. There are two theories with regard to the pathogenesis of the secondary infection. They have been considered by some to be the result of an extension of the gonorrhœal process, and an infection of remote parts with gonococci; and by others to be the result of a mixed infection, and to be due to various organisms, especially the pus organisms which have entered into the tissues from the

local lesions and been carried to the various secondary foci. Gonorrhœal rheumatism is the most common of the secondary affections following gonorrhœa, and a great deal has been written about it.

One of the most extensive articles on the subject is that of Loeb in the "Deutsches Arch. für klin. Med." Different authors give different figures as to its frequency. Fournier, who has had the most extensive experience and the largest number of statistics, gives one case of joint affection to sixty-four of gonorrhœa. Besnier gives the relation of 1 : 50, and Grissolle as 1 : 35. Loeb, without giving any definite figures, thinks that the affection is much more frequent than would appear from these figures. Some authors are disposed to deny any connection at all between the rheumatism and the gonorrhœa; others think that there must be an especial predisposition to rheumatism which is called into activity by the urethral affection. In most cases the rheumatism does not seem to be produced early in the disease. It frequently follows a torpid state of the gonorrhœa, and rarely appears before five to fourteen days. As a rule, most authors agree that the rheumatism is only seen when the gonorrhœal process attacks the posterior portion of the urethra. It is certainly much more frequent in men than in women. There seems to be a marked difference in the symptoms produced in gonorrhœal rheumatism as compared with those in the ordinary forms. Fever may be entirely absent in gonorrhœal arthritis, and even when it is present it has not the same duration, and it may disappear while the affection of the joint obstinately continues. In some cases, however, there may be a considerable increase of the temperature in gonorrhœal rheumatism. Its duration is longer than the ordinary rheumatism. The number and situation of the joints differ in two cases. Generally speaking, in the gonorrhœal rheumatism fewer joints are affected than in the ordinary form. The knee-joint is one of those most frequently affected. The joints of the upper extremities are very frequently free. In Nolen's one hundred and eighteen cases the wrist-joint was affected twenty-six times, and in Fournier's one hundred and nineteen cases only fourteen times. There is a further difference between the two affec-

tions in the result of the treatment. The gonorrhœal joint affections do not yield to the treatment with salicylates as do the ordinary forms. In very few cases does the arthritis lead to suppuration and destruction of the joints.

Affections of the peri- and endocardium are also frequently seen as a complication of gonorrhœa. They are usually seen in combination with rheumatism, but they are by far less frequent in gonorrhœal rheumatism than in the other forms. Zeissl regards the comparative freedom of the peri- and endocardium from infections as characteristic of gonorrhœal rheumatism. Nolen found fifteen cases in which the heart was affected in his one hundred and sixteen cases of gonorrhœal rheumatism, but it is probable that his figures are overdrawn. There are a number of cases reported clinically in which an affection of the peri- and endocardium has been found in gonorrhœa. Traube makes repeated mention of heart affections in gonorrhœa.

With regard to the buboes, there need be no special reference. They are frequently found in gonorrhœa in both the male and female. The cultures made from the glands after removal are usually sterile.

In a number of cases organisms which have been considered to be gonococci have been found in association with these secondary lesions. Petrona claims to have found cocci in the joint affections which were similar to those found in the urethra, and he even found them in the blood in cases in which the joints were affected. Kramer also found gonococci in the joints. They were present in one of his cases, and in the other no organisms at all were found. Hahn has found cocci in gonorrhœal affections of the joints, but he does not regard them as true gonorrhœal organisms, but simply as pus organisms. He says that the organisms are only found in cases where the process in the joints is fresh and advancing rapidly. Where the process is more chronic they are not found. Haslund believes that the gonorrhœal rheumatism is due to a specific infection from the inflamed mucous membrane, but he was not able to find the gonococci in the joints. Leistikow investigated four cases of gonorrhœal arthritis, and found no organisms in the contents of the joints, nor in the blood of the patient. Hartley investi-

gated a number of cases of gonorrhœal rheumatism in which he found typical cocci in the fluid. In a recent publication he inclines to the belief that the secondary affections are due to accidental infections with other organisms. With regard to the cardiac affections in gonorrhœa, they appear to be usually either cases of pericarditis or of endocarditis. Schaeder published a case of endocarditis ulcerosa which followed a gonorrhœal rheumatism, the rheumatism appearing three weeks after the beginning of the gonorrhœa. Eight months later symptoms on the part of the heart appeared which resulted fatally. Glusinski describes thirty-one cases in which complications on the part of the circulation were found in the course of gonorrhœa. All of his cases were clinical. He has recently reported a case of gonorrhœal endocarditis with extensive vegetations on the valves, in which organisms similar to those in the accompanying urethritis were found.

The gonococci have been found by various authors in the buboes following gonorrhœa, in the peri- and para-urethral abscesses, and in the various other local lesions. They have also been found in the tubes in cases of salpingitis following gonorrhœa. At present the belief is general that chronic salpingitis in the female is due to gonorrhœa. Organisms of the same general character as the gonococci have been found in the diseased tubes. So far as we can see from this brief review of the literature, there are a number of varying opinions as to the pathogenesis of the secondary gonorrhœal affections, some believing that they are due to a specific infection with gonococci, while others believe that they are due to an accidental infection with other organisms which enter the tissues from the local lesions in the urethra.

The following case is of much interest, not only on account of the unusual character of the lesions, but from the opportunity which was given for a close histological study of the acute process in the urethra and elsewhere. The case is from the Boston City Hospital, in the service of Dr. Post, to whom I am indebted for the notes of the case.

W. H., admitted to the hospital September 30. Urethral discharge first noticed four weeks before admission. Ten days after the gonorrhœa was first noticed, the left knee

began to swell, and became painful. This condition lasted three or four days, then extended to the right knee. Since the attack he has had pain and swelling in fingers, shoulders, ankles, etc. Cannot take long breath on account of pain in chest. On October 6 the pain in chest ceased, after having lasted since entrance. Pain in right knee persisted. Temperature remained normal. October 7 he complained of much pain in chest. On examination there was a slight increase in cardiac dulness, but no murmur or pericardial rub. October 8, pain in chest continued, and leeches were applied for its relief. October 9, slept well, awoke at six and took his milk. At seven cried out as in pain, and fell out of bed. The house-officer, who was summoned at once, found the patient gasping for breath, and no pulse perceptible at wrist. Patient died almost immediately after being seen by house-officer. Temperature during the whole course of the attack did not exceed 99½°. The pulse kept under 110. The respirations were accelerated. The autopsy was made twenty-eight hours afterward.

The body was of medium size, slightly built, badly nourished. The general surface cyanotic. Both knee-joints, especially the right, enlarged and gave clear fluctuation. The subcutaneous fat small in amount; muscles rather pale, somewhat diffusely stained with blood. The lungs somewhat stained with blood. The spleen slightly enlarged; both that and the liver free from adhesions. No adhesions in peritoneum. Peritoneal surface smooth everywhere. Diaphragm depressed on left side. Both lungs free from adhesions, and compressed by distended pericardium. The posterior and lower portions of both lungs congested and œdematous. Mucous membrane of bronchi congested; vessels at root of lung free. Pericardium enormously distended. The external surface congested and covered with small hemorrhagic foci. In the pericardial cavity a large amount, about 800 cc., of hemorrhagic exudation, in which there are large masses of clot. Both surfaces of peritoneum covered with thick membranous masses containing hemorrhages. The heart is firmly contracted. The aorta is very narrow. The myocardium of left ventricle is firm, and of a peculiar pale waxy color, somewhat resembling amyloid. Towards the endo-

cardium, especially about the base of the papillary muscles, the tissue has a grayish, translucent, gelatinous appearance. This extends in places into the tissue of the myocardium for a considerable distance. It is especially marked towards the apex of the ventricle. In places this pallor and translucent appearance is associated with marked hemorrhagic infiltration. This condition of the myocardium is almost confined to the left ventricle. There is some evidence of it on the right side, but it is not so well marked. On the anterior inner surface of the left auricle there is an area of $2 \times 2\frac{1}{2}$ cm. where the muscular tissue is substituted by a pale opaque tissue; the centre of this is soft and almost broken down.

The spleen is enlarged; the follicles prominent. Both liver and kidneys show slight acute swelling. All of the follicles of both large and small intestines are enlarged and hyperæmic. In the small intestines the follicles have the character of small polypi. The Peyer's patches are enlarged, but there is no ulceration. All of the mesenteric lymph-glands are slightly enlarged. The right knee-joint is generally distended. On section about 100 cc. of gelatinous pus escapes. The pus is stringy and rather transparent. The muscles above the joint, in the immediate neighborhood, show some diffuse purulent infiltration. The synovial membrane of the joint is swollen and intensely congested. There are papillary fungoid projecting masses of granulation tissue extending into the joint, having somewhat the appearance of masses of tuberculous granulations. On sections these projecting masses have a white opaque edge, and below this the tissue is gelatinous and œdematous. The left knee-joint contains a smaller amount of this material. The joint is somewhat altered, but not to the same extent as the right. There is no general granular enlargement.

The entire mucous surface of the urethra appears to be thickened and softened. The peri-urethral tissue is thickened and dense. About 4 cm. from the meatus there is a slight ulceration on the surface, apparently only involving the mucous membrane. The mucous surface is covered with a slight purulent exudation. Pus can be squeezed from the seminal ducts. There is a purulent infiltration extending

from here into the prostate. On each side of the prostate an extensive purulent infiltration of tissue, with softening, and on the left side is a distinct abscess. The seminal vessels, testicle, and epididymis show no alteration.

Microscopic examination of the pericardial exudation showed hemorrhage, large numbers of pus cells, and large epitheloid cells. No gonococci were found in this exudation. The examination of cover-slips made from the urethra and from the knee-joint showed the presence of gonococci. They were abundant in the urethra, but comparatively few were found in the joint. In both places the organisms were only in the pus cells, and appeared to be identical. It is to be regretted that at the time it was not possible to make cultures from the tissues. All of the tissues were hardened in alcohol and subsequently examined.

Microscopic examination of the urethra. Section of the gland shows no lesion of the epithelium. Here and there on the surface there are adhering pus-cells, some of which contain the gonococci. There is a gradual transition of the epithelium of the gland into that of the modified cylindrical epithelium of the urethra. The epithelium of the urethra is composed of numerous layers, but the cells have more the character of the cylindrical epithelium. The pigmented layer disappears, and the papillæ become less prominent. Just within the urethra there is a deep crypt, with several papillary projections from its wall. Here and there over the surface of this the epithelium appears to be broken through, and there is an intense round-cell infiltration of the subcutaneous tissue. There are very few pus cells mixed with the round-cell infiltration. The tissue immediately beneath the mucous membrane, along almost the entire length of the urethra, shows a round-cell infiltration which is more or less focal, and in some places more intense than in others. In the vessels of this tissue there are a comparatively small number of leucocytes, and in places emigration is apparently taking place. The plasma cells in the tissue are very numerous, and many of them appear strikingly like cells filled with micro-organisms. There is no basement membrane giving a sharp line of demarcation between the epithelium and the tissue beneath. In the epithelium there

is a considerable number of polynuclear leucocytes among the epithelial cells. In places there are irregularities on the epithelial surface, and small depressions resulting from the softening and breaking down of the cells. Gonococci are found in relatively small numbers. They are in the epithelium, both between and in the cells, but the greater part of them are found in the pus cells on the surface of the epithelium and between the epithelial cells. None are found in the deepest layers of the epithelium, nor are they in any of the tissues outside of the epithelium. Nuclear figures are found in the epithelial cells in the lower layers corresponding to the place where the lesions on the surface are most marked. The gonococci were found both as masses, filling up the entire cells, and as single pairs. The mucous membrane throughout the urethra in all the sections appears to be softened and exfoliated, and in places the granulation tissue is directly continuous with the surface. The subepithelial crypts show about the same condition as the surface of the urethra. The mucous membrane in places is entirely absent, and the granulation tissue comes distinctly to the surface. The cells found in the granulation tissue are of the ordinary types — both ordinary granulation cells and those with larger nuclei. The gonococci are always most abundant where the purulent infiltration of the mucous membrane is most intense. They were found in the crypts and in the pockets of Morgagni, but in general they were less numerous here than on the surface of the urethra. Deep down in the tissue there are no lesions whatever to be made out. On sections passing through the membranous portion of the urethra, near the prostate, cutting across the numerous ducts and crypts, the same condition was found as in the other portions of the urethra. In the prostatic ducts there was an intense purulent inflammation, but very few gonococci were found. The prostatic ducts showed a purulent infiltration of the wall and of the surrounding tissue. In many places the epithelium was entirely destroyed. This condition extended up into the prostate, and on one side of this the tissue was entirely broken down, resulting in the formation of an abscess. No gonococci or other organisms were found in the abscess. The only other organisms found

in the urethra were a few short bacilli on the mucous surface, which apparently had nothing to do with the inflammation, and were only accidentally present.

Sections from the heart from various places were examined after being hardened in alcohol. There is everywhere an intense pericarditis. The pericardium is universally thickened and swollen. In some places it has a thickness of two or three mm. The surface is generally smooth, but in places there are well-marked papillary projections. There is some fibrin loosely adherent to the surface, but there is no definite fibrinous exudation. In the thickened pericardium there are numerous widely dilated blood-vessels with thin walls. It is probable that the blood found in the pericardial cavity came from the rupture of these vessels. The thickened tissue of the pericardium is loose, infiltrated with pus cells, and contains numerous large round cells, some of which enclose pus cells in their interior. There are various changes in the myocardium, which are more extensive close to the endocardium than elsewhere. In the least marked lesions in the myocardium there appears to be simply some infiltration with pus cells along the connective tissue septa, which are thickened and swollen. In some places the lesions in the myocardium, although most intense near the endocardium, appear to extend from the pericardium, and can be traced directly to this. In all of the areas where the purulent infiltration is seen there are various degrees of degeneration of the muscular fibres. In the slightest degree of degeneration they appear to be slightly swollen, diffusely stained, their nuclei disappear, and they frequently contain vacuoles. There is every degree of change from this up to a total necrosis of the muscular fibres, and an entire substitution of areas of purulent infiltration and necrosis for the normal tissue of the heart. There is little or no formation of granulation tissue. Some of the areas where the degeneration is most extensive involve almost the entire thickness of the ventricle extending up to the pericardium. In such places there are large areas of necrotic tissue, with purulent infiltration extending widely into the tissue beyond the necrosis. The most pronounced lesion is found in the left auricle. In this there is a very large area of necrosis and

suppuration, which involves the entire thickness of the wall. Extensive hemorrhage was found in some of the necrotic foci. This was most extensive in the auricle. The gonococci are found in the sections in considerable numbers. They were most numerous in the most acute focus in the auricle. They were also found in the ventricle, but in much smaller numbers. In the pericardium very few were found. In the left ventricle they were present in some of the sections in enormous numbers. In places almost every pus-cell contained them. None were found in the tissue outside of the cells.

Sections of both knee-joints were examined after the tissue was hardened in alcohol. On the surface, corresponding to the opaque appearance noticed at the autopsy, there is an area of purulent infiltration extending only a short distance into the tissue, not more than 1 mm. In this tissue the vessels were dilated and tortuous, and frequently contained numerous pus cells. In the tissue beneath there are comparatively few pus cells. Most of the cells here are large and swollen, conforming to the general type of the epitheloid cells, and frequently containing large vacuoles within them. The surface of the joint is generally smooth, but in places it shows small depressions. The gonococci were found in but comparatively small numbers. They were never deep down in the tissue, but were always either immediately on the surface or in the most superficial layers. They are most numerous where there are slight depressions and where the inflammatory process appears to be most intense. They were only found in the cells, and in their general character they agree with those found in the urethra.

When we look over this case we see that we have an acute gonorrhœa associated with remote lesions. These lesions appeared some time after the beginning of the attack of gonorrhœa, and in their general character they do not correspond with the lesions produced by the pus organisms. The process in the pericardium is not at all similar to any of the forms of peri- or myocarditis which are produced by other organisms. The most striking feature is the absence of any fibrinous exudation. The process consists in the production of various degenerations of tissue, and necrosis with purulent

infiltration, and a more or less extensive reaction on the part of the tissue shown in the formation of granulation tissue. In the knee-joint, also, the process is a peculiar one. There is a comparatively slight extent of distinct purulent infiltration, but the main thing is a formation of granulation tissue with mucoid degeneration of the cells. The presence of this mucus coming from the cells gives to the purulent accumulation in the joint its viscid and gelatinous character. Our conception of the process in the urethra agrees almost exactly with that of the study which Bumm made on the conjunctiva. The process, as far as the bacteria are concerned, is a distinctly superficial one. There is more or less loss of the epithelium with purulent infiltration. In the surrounding connective tissue there is an extensive formation of granulation tissue. No gonococci were found in the depths of the tissue.

As we have said in the beginning, there are two opinions regarding the secondary lesions in gonorrhœa: One that they are due to a mixed infection, probably to other organisms than the gonococci entering the system from the lesions of the urethra; the other, that they are due to a direct metastasis of the gonococci. From the examination of this case, I think there is but little doubt that the secondary lesions were produced by the gonococci, the same organism found in the urethra. Unfortunately, the case is not a complete one, owing to the absence of cultures at the time of the autopsy. The organisms were only studied on the cover-slip preparations and in sections. The sections showed apparently the same organisms in the tissues as were found in the mucous membrane of the urethra. It is not possible to absolutely distinguish the gonococci from the pus organisms by their morphology alone. Streptococci are often found in the pus cells arranged in pairs, and resembling in almost all respects in their morphology the gonococci. They are not, however, as a rule, found in groups of four, as the gonococci frequently are. We also have a distinguishing mark for the gonococci by their reaction with staining agents. All of the pus organisms retain their color after staining by the Gram method. The organisms found in this case were all decolorized. Although the pus organisms are frequently found in

cells, this is not their exclusive position. In any case where they are found in the cells they will be found in the tissue also, not contained in cells. The organisms found in this case conform with the gonococci, in that they were all decolorized by the Gram staining, and were only found in the cells. Moreover, the lesions which were produced were not such as we would expect to be produced by the pus organisms, or even by the pneumococci. Clinically the course of disease, especially the absence of fever, which almost all observers have noted a characteristic of the secondary gonorrhœal affections, also speaks in favor of a gonorrhœal instead of a purulent infection. In this case, in spite of the extensive involvement of the joints and of the heart, there was almost an entire absence of fever. In cases of purulent infection, as we ordinarily see it, we do not have these same typical metastases which we have in gonorrhœa. There is no reason why an ordinary purulent infection, which takes place from the urethra, should be localized in the joints or in the pericardium. I think that, apart from the direct objective facts which point in favor of the secondary gonorrhœal affections being due to infection with gonococci, a general consideration of the subject will also incline us to this belief.

VI.

A CASE OF MULTIPLE RUPTURE OF INTERNAL ORGANS PRODUCED BY A FALL.

By W. T. Councilman, M.D.

The patient, a laborer, was brought into the hospital for injuries sustained in a fall from a roof. There had been a very severe snow-storm, and the man had been engaged in cleaning off the snow from a roof. He fell to the ground, bringing with him a large amount of snow. The height of the roof was somewhat under twenty-five feet. No previous history could be obtained from the men who brought him in. On physical examination the pulse was weak and somewhat fluttering. Pupils of equal size. Knee-jerk increased. The man was very noisy and hyperæsthetic. No definite external bruise could be seen, and no localized tenderness was made out. A few hours later the man became quiet and unconscious. The next day the patient was still unconscious; the diagnosis was made of right meningeal hemorrhage, and a button of bone taken out. There was a considerable escape of clear, watery fluid from the opening. No hemorrhage to be made out. The pulse was very weak at the time of operation, and numerous subcutaneous injections of brandy and digitalis were given. The pulse became somewhat stronger. Later the pulse gradually grew weaker, respiration became slower and slower, and death took place at 6.30 P.M., thirty hours after the injury. After death information was obtained from a friend of the man that he had been previously subject to periods of insanity, which in some cases were of a violent character.

AUTOPSY (TWENTY–FOUR HOURS AFTER DEATH).

The body is that of a large, strongly built, muscular man. On the right side of the head there is a crescentic-shaped

incision, commencing shortly behind the left ear and extending upwards and forwards, terminating over upper portion of the frontal bone. On the posterior surface of the thorax on the right side there is a large, subcutaneous hemorrhage, evidently due to contusion. No evidence of injury elsewhere.

In the right side of the skull, corresponding to the incision through the scalp, there is a round opening with smooth edges, the anterior portion of which is one centimetre posterior to the middle meningeal artery. The dura at this point has been opened. The calvarium smooth. No evidence of fracture. The dura is thickened and slightly adherent to calvarium. The thickening is more marked on the right side. On the inner surface of the dura, on the right side, there is a slight membranous formation, which can easily be stripped off, and in which numerous small hemorrhages are seen and points of brownish pigmentation. There are several foci of softening on the right side of the brain. These are more marked in the temporal region than elsewhere. The largest of these is in the first temporal convolution. It is three centimetres long, with irregular edges, and quite superficial. The base is smooth and firm. The edges are yellow and sharply defined. At no place does the loss of substance extend more than three millimetres into the brain. There are similar but smaller losses of substance in the second and third temporal convolutions, and a very small one in the angular gyrus just above the fissure of Sylvius. There is also an area which is yellowish and slightly softened in the anterior central convolution opposite the second frontal involving a portion of the cortex one centimetre in diameter. The pia is of ordinary thickness, easily stripped off. The vessels at base of brain and throughout brain perfectly normal. No pathological condition is made out within the brain itself. The base of skull shows no change. The ears and drum membranes perfectly intact.

The subcutaneous fat is slightly developed; muscles red. The peritoneum is smooth, and its entire posterior surface is elevated by an extensive hemorrhage beneath it, giving to it a dark, almost black color.

Liver and spleen free from adhesions. Diaphragm on

right side at lower margin of fourth rib; on left, at fifth intercostal space.

Both lungs are voluminous; the left free from adhesions. The pleura smooth. The entire posterior portion of left lung and the entire lower lobe are intensely congested and show numerous areas of hemorrhage, which in part are small and circumscribed, and in part form large irregular areas which are evidently due to confluence of the smaller. These areas are somewhat similar to areas of broncho-pneumonia, and are in connection with the bronchi. The blood-vessels of the lung are normal. In the bronchi there is a small amount of mucus mixed with blood. In addition to the areas of hemorrhage, the entire lung is somewhat œdematous. The most congested portion of the lower lobe floats in water. The parietal pleura along the vertebræ is congested, and there is an infiltration of blood beneath it.

The right lung shows a few old and tolerably firm adhesions, which are most marked along the lateral surface of the lung. Almost the entire sub-pleural tissue of the wall of the thorax on this side is infiltrated with blood. This is most marked along the posterior surface, and extends from this around the apex of the thorax and down to the diaphragm, gradually becoming less in extent. There is no blood within the pleural cavity. The entire right lung is heavy and voluminous. The entire lower lobe, especially the posterior portion, is dark and hemorrhagic. In one or two places the pleura is slightly elevated, apparently from hemorrhage beneath it. Over the entire lung the pleura is perfectly smooth, with the exception of the places corresponding to the attachment of the old adhesions, and shows no rent or fissure. A section through the posterior surface of the lower lobe shows an extensive, irregular cavity filled with blood. The cavity is six centimetres long, and represents a long, irregular fissure of the lung, with lateral fissures radiating out from it. In several places it is immediately beneath the pleura, and the pleura in this place is separated from the lung by a mass of blood-clot which communicated with the cavity. The cavity contains about fifty cubic centimetres of dark, clotted blood. The wall of the cavity, though irregular, is comparatively smooth. It

does not represent a definite loss of substance in the lung; and on removing the coagulated blood contained within it, the walls of the cavity come into perfect apposition. The hemorrhage here extends over the entire posterior part of the lower lobe. The lung is solid and sinks in water. Elsewhere there are smaller and more circumscribed hemorrhages. The vessels of the lung are normal. No single, large vessel can be traced into the cavity. The cavity connects with the bronchi in several places. Elsewhere in the lung there is a slight amount of œdema.

Both layers of pericardium smooth. On the left ventricle, just at the juncture of the ventricle with the auricle, there is a large ecchymosis beneath the pericardium. The heart of ordinary size and weight. Firmly contracted. All of the valves of the heart normal. Coronary arteries normal. In the left side of the heart there is a firm mural thrombus two centimetres in diameter, which is attached to the auricle and the mitral valve at its ring of insertion. It is attached just above the middle of the aortic segment of the valve. On removal of the thrombus, it is found attached to a fissure in the endocardium of the auricle, which commences in the auricle just above the valve and extends downward into the valve. This fissure is one centimetre in length, and corresponds to the situation of the sub-pericardial hemorrhage. The papillary muscle corresponding to this place also shows small fissures at the insertion of the cordæ tendiniæ, with hemorrhagic infiltration of the myocardium about them. These fissures are covered with a thrombus. The aorta is smooth.

The intestines are somewhat distended with gas, and are hyperæmic. The mucous membrance of the entire intestinal canal normal.

The entire posterior peritoneum is elevated by an extensive hemorrhagic infiltration beneath it. This infiltration is more marked in the lower portion of the peritoneal cavity extending into the pelvis, and is more on the right than on the left side.

The spleen of normal size and consistency.

The liver large, rather pale and anæmic. The peritoneal

surface smooth, the lobules visible. The gall-bladder contains rather thin, yellowish bile; the bile-ducts open.

Pancreas and adrenal glands normal.

The right kidney has an extensive hemorrhagic infiltration around it. Its capsule is loose, and elevated by the hemorrhage. There are numerous irregular fissures on both sides of the kidney; and in the middle there is a large fissure with an interval of one to two millimetres between the edges, which is filled with coagulated blood. Most of the fissures do not extend into the kidney for a distance of more than one to five millimetres, and none of them communicate with the pelvis. On section, there is a hemorrhagic infiltration in the neighborhood of the fissures. Elsewhere the kidney is pale. About the left kidney there is also an extensive hemorrhagic infiltration of the perirenal tissue. The surface of left kidney is smooth and free from adhesions. The capsule of the left kidney is slightly elevated above the surface. On section, the entire organ is distinctly congested, and blood can be pressed from the cut surface everywhere. The renal artery is occluded by a thrombus which extends up to the aorta. The renal vein is also thrombosed.

Both adrenal glands are imbedded in the hemorrhagic infiltrated tissue. The pancreas shows no change. The urinary bladder and genitalia are normal.

The most careful examination showed no fracture of the walls of the thorax, nor of the pelvis nor vertebræ. No fractured bone could be found in any portion of the body.

ANATOMICAL DIAGNOSIS.

Traumatic rupture of the right lung, heart, and kidney. Pulmonary hemorrhage from rupture. Thrombosis of heart. Sub-pleural, sub-peritoneal hemorrhage from rupture. Embolus of left renal artery. Thrombosis of renal vein. Hemorrhagic infarction of left kidney. Operation wound in scalp and skull. Old areas of softening in brain. Chronic pachy-meningitis.

This case is in many respects an exceedingly interesting one. Although there are many cases reported of rupture of the lung and other internal organs without injury of external parts which would correspond with them, I have

found no case in which the injuries of the viscera were so extensive. Most of the cases of rupture of the lung without injury of the thorax which have been reported have been due to direct violence applied to the wall of the thorax. The most frequent cases are those in which a wheel has passed over the thorax, or in which the thorax has received a violent blow. Cases have also been reported in military surgery of injury to the lung, sometimes followed by gangrene, from the effect produced by a spent cannon-ball striking the thorax. In all of these cases it has been assumed that the thorax was in a condition of extreme distention at the time of the injury, and the glottis firmly closed.

The man in this case fell from a height of less than twenty-five feet, bringing a lot of snow down with him. It could not be ascertained whether the contusion of the thorax was due to his having fallen on a projecting body. It is interesting to see that the rupture of the lung had been produced without any injury to the pleura over it. The hemorrhagic infiltration extended over the rupture to the base of the lung, and from here on all sides, still beneath the pluera. There was no blood at all in the thoracic cavity. A close examination failed to show the rupture of any large vessel in the lung.

It is hardly possible to conceive that there should have been a rupture of one of the pulmonary vessels which had caused the destruction of the lung tissue. The case would have been more easily explained had there been numerous adhesions between the chest wall and the lung, but the adhesions in this case were almost entirely wanting. It is still more difficult to explain the rupture of the endocardium, and I have not been able to find the report of an analogous case in the entire literature. It is hardly possible to conceive of such a sudden increase of intra-thoracic pressure combined with intra-cardiac pressure which could produce such an injury. It would be more easily accounted for by a diminished intra-thoracic pressure combined with an increased intra-cardial. There was an entire absence of any disease of the valve or of the endocardium which would have made the liability of injury greater. The blood-vessels in the body everywhere were normal.

When we think of the anatomical structure and the situation of the organs in the thorax, it is difficult to understand how, in such an elastic tissue as the lung, an injury could take place as the effect of indirect violence. A consolidated lung is, of course, easily torn, because, owing to the inability of the lung to collapse, any violence applied to it acts only on a small portion of the tissue at a time. But here there was no evidence of there having been any previous consolidation. How the injury of the heart took place we have no means of knowing.

The rupture of the kidney is more easily understood, and cases are not uncommon of rupture of the kidney which have resulted from various forms of external injury. I know of one case in which a man fell from the roof of an omnibus, and, striking on the right shoulder, rupture of both liver and kidney took place. It is probable that the thrombus of the left renal vein was due to the injury of the tissues around the vein produced by the infiltrated blood. The embolus which plugged up the artery on the same side had evidently come from the thrombus in the left heart. That infarction of the kidney should have taken place after closure of both renal artery and vein is a direct confirmation of Litten's experiment. In Conheim's explanation of infarction after the closure of an artery, he assumes that the blood in the infarcted territory comes from a backward flow from the veins. Litten afterwards showed that the infarction took place when both vein and artery were tied, the blood entering into the tissue from the anastomosing vessels of the capsule, and from the vessels along the course of the ureter. No infarction followed the ligation of the artery and vein when the capsule was stripped from the kidney and the ureter tied.

VII.

OBSERVATIONS ON PNEUMONIA.

By Wm. H. Prescott, M.D.

ACUTE FIBRINOUS PNEUMONIA WITH UNUSUAL EXTENSION OF THE FIBRINOUS EXUDATION.

There is nothing of especial importance in the clinical history of this case. The patient, a man about thirty-five years old, was brought into the Hospital with well-marked evidences of pneumonia. There was complete consolidation of the lower half of the left lung and bronchial breathing, with less well-marked consolidation in the lower posterior portion of right lung. The temperature was high, and the breathing very much accelerated. The condition of the patient steadily grew worse, and he died forty-eight hours after entry into the Hospital.

The autopsy was made November 25, twenty-four hours after death. The body is that of a slightly built man. The mucous membrane pale, rigor mortis well developed. The superficial veins over chest prominent. The face cyanotic.

Scalp slightly adherent. Dura mater of ordinary thickness. Pacchionian granulations well developed. The pia slightly cloudy. The convolutions of brain well marked. Brain slightly œdematous.

Subcutaneous fat slight in amount. Muscles red. Peritoneal cavity moist. The appendix bound down by old adhesions extending across from the ileum. These adhesions involved the proximal two-thirds of the length of the appendix, leaving the tip free. The peritoneum over appendix thickened. Diaphragm on right side at lower border of fifth rib; on left side, in fifth intercostal space.

In the left pleural cavity about 500 cc. of cloudy serum containing flakes of fibrin. Both cavities free from old adhesions. Lungs do not retract on removal of sternum. The pre-cardial space small. On the anterior surface, especially over the upper two-thirds, there is a thick fibrinous deposit on the epi-pericardial tissues. The pericardial cavity is obliterated over the anterior upper portion by fresh, thick fibrinous adhesions. In the lower portion of the cavity there is a small amount of clear fluid. The visceral pericardium in its upper portion, extending especially over the root of the aorta, is covered with a thick fibrinous exudation, containing here and there small hemorrhages. The myocardium is generally pale. Immediately beneath the pericardium where the exudation is thickest the tissue is somewhat opaque and contains small hemorrhages.

The heart of ordinary size. On the right segment of the mitral valve near its attachment, there is a minute superficial erosion not more than 1 mm. in extent, covered with a thin, granular, hemorrhagic fibrinous deposit.

Over the entire pleural surface of the left lung there is a thin fibrinous exudation, and in the pleura beneath it there are numerous small hemorrhages. Over other portions of the pleura the exudation is thick and yellowish, and is easily removed as an adherent membrane, leaving the underlying pleura cloudy. The upper lobe of this lung is hyperæmic, œdematous, and more solid than normal. On pressure much blood-stained serum can be squeezed from the cut surface, and thick purulent exudation from the bronchi. The upper and lower lobes united by fresh adhesions. Fully two-thirds of the lower lobe is completely solid. The cut surface of this is gray, granular, and on pressure pus can be squeezed from the bronchi. The remainder of the lobe is intensely congested and partially solidified. Portions of the lobe will float in water. The costal pleura on the left side is covered with a thick fibrinous exudation. On being stripped off the vessels in it are enormously dilated, and hemorrhages have occurred everywhere in the tissues. The intercostal muscle, especially in the upper half of the pleural cavity, appears swollen and softened. On section the intercostal muscle and sub-pleural tissues are thickened by an exudation which is in-

timately associated with the tissues. This exudation in places appears to extend through the entire thickness of the intercostal muscle, and there is apparently a sharp line separating it from the healthy tissues. At the apex of the pleural cavity a similar condition exists, and extends from here into the posterior mediastinum, and into the cervical regions. Some of the deep-lying cervical lymph-glands are reddened and swollen, and around them this fibrinous exudation is seen. In one place in the epi-pericardial fat there is a small collection of thick, creamy, gelatinous pus. The right lung is voluminous. The pleura smooth and free from fibrinous deposit. On section the lung is in general hyperæmic and œdematous. In the lower lobe there are scattered foci of consolidation varying in size from 1 to 5 cm. Pus can be squeezed from the bronchi in these places.

Liver is large. The surface pale. On section cloudy and opaque with indistinct lobules. The bile duct free. The gall bladder contains clear, yellowish bile.

The kidneys somewhat enlarged. Capsule easily stripped off. Surface smooth. On section, markings somewhat obscure. Cortex swollen and opaque. Glomeruli anæmic.

The spleen slightly enlarged. The capsule wrinkled. On section rather soft and dark. Neither trabeculæ nor malpighian bodies are visible. The adrenal glands and pancreas normal. The mucous membrane of stomach and intestines is hyperæmic, otherwise normal.

The mucous membrane of larynx and trachea is congested. Beginning in the lower part of the larynx and continuing uniformly through the trachea as far as the bifurcation, the mucous membrane has a granular appearance due to the presence of small vesicular-looking granules of regular size on the surface. This does not disappear on washing, but on gently rubbing the granules disappear and a thick fluid takes their place. This condition is due to small masses of the mucus distending the gland. The aorta and other arteries are normal.

ANATOMICAL DIAGNOSIS.

Acute fibrinous pneumonia with consolidation of lower lobe of left lung. Slight consolidation in upper lobe of left

lung. Fibrinous lobular pneumonia of right lung. Acute fibrinous pleurisy of left pleura with extension of the process into the chest walls and into the posterior mediastinum. Acute fibrinous pericarditis with extension into myocardium. Acute endocarditis of mitral valve. Acute parenchymatous degeneration of liver, heart, and kidneys with slight fatty degeneration.

Cover slips made from the lung, from the fibrinous exudation on the surface of the pleura and from the pericardium, showed large numbers of the diplococcus lanceolatus with well-marked capsule staining. In the fresh sections of the intercostal muscles the same condition was found. Fresh sections of the kidney showed swollen and granular epithelium in the convoluted tubules, with here and there minute drops of fat on the addition of acetic acid. The glomeruli were unchanged. Sections of the liver showed swelling and granular degeneration of the hepatic cells. Sections of heart showed a very slight fatty degeneration of the muscle. Portions of the various tissues were hardened in alcohol for further examination.

Microscopic examination of the consolidated portion of left lung. The alveoli are everywhere distended with fibrin and pus cells. Numbers of diplococci were found in the pus cells. Sections made from the less consolidated portions of this lung and from the areas in the right lung show a less advanced process. The vessels in the alveolar walls are dilated, and the walls themselves infiltrated with leucocytes. Within the alveoli there are small amounts of fibrin with numerous red and white corpuscles.

The most interesting conditions were found in the pericardium and in the pleura. The fibrinous exudation of the pericardium is very dense, and the fibrin is in places in the form of large, broad fibres which are frequently united together to form hyaline masses and a reticulum, somewhat similar to that in the diphtheritic membrane. In places it extends into the tissue of the myocardium. In these places there are numerous leucocytes, round and epitheloid cells between the muscular fibres. The muscular fibres appear swollen, and the nuclei are indistinct. In the least affected part of the myocardium there are no leucocytes in the tissue, but there are

numbers of large epithelioid cells and round granulation cells between the muscular fibres. In these places there is no fibrin, and the muscular fibres themselves appear to be but little altered. Farther back in the more affected portions the leucocytes are found, and with these masses of fibrin. Diplococci were found in great numbers in the exudation, both enclosed in the pus cells and scattered through the fibrin. None were found where the tissue contained only the epithelioid and round cells.

The process appears to invade the fat in the same way. In places, as observed with the low power, the fibrinous exudation and the leucocytes extend directly into the fat, passing along the connective tissue septa.

On examination with a higher power, in the areas of fat, which under the low power appeared to be unchanged, there is a similar condition to that found in the myocardium. (Fig. 1.) There are numerous large epithelioid cells between the fat cells, of the same character as those found in the myocardium. The fat vesicles themselves appear to be somewhat compressed and distorted by the formation of cells between them, but are otherwise unchanged. In some places only one or two of these larger cells were found, and in others they are more numerous. The inflammatory process appears to extend into the tissue along the lymphatics and blood-vessels. In one place a longitudinal section of a capillary is seen, the nuclei of which are swollen and granular, and the lymph sheaths of the larger blood-vessels are completely filled up with these large granular cells.

Examination of the intercostal muscle shows a similar condition. The fibrinous exudation with leucocytes extends into this, generally in the form of large bands in the intermuscular septa. There is also an extension in muscle nearest the pleura between the individual muscular fibres. In the most affected places the muscular fibres are swollen, granular, and necrotic; the nuclei do not stain, and they have lost the cross striation. In advance of the fibrinous exudation with leucocytes there is simply a cellular infiltration without either fibrin or leucocytes. (Fig. 2.) The cells in this are almost all of them large epithelioid cells with a clear, brightly staining nucleus. In one or two places nuclear

Fig I

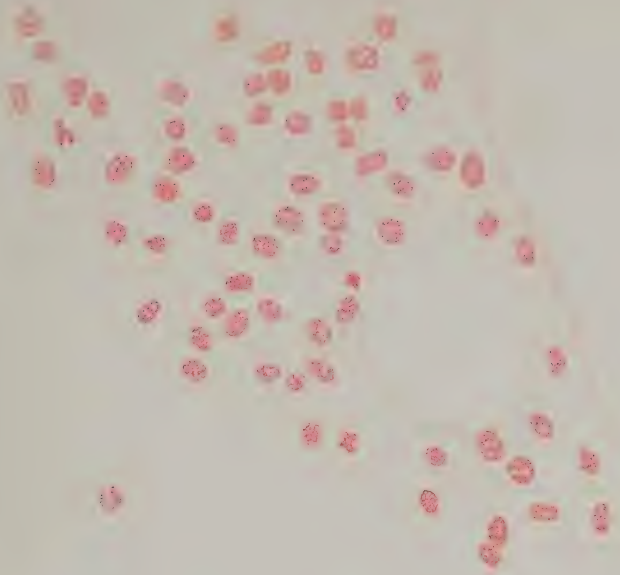
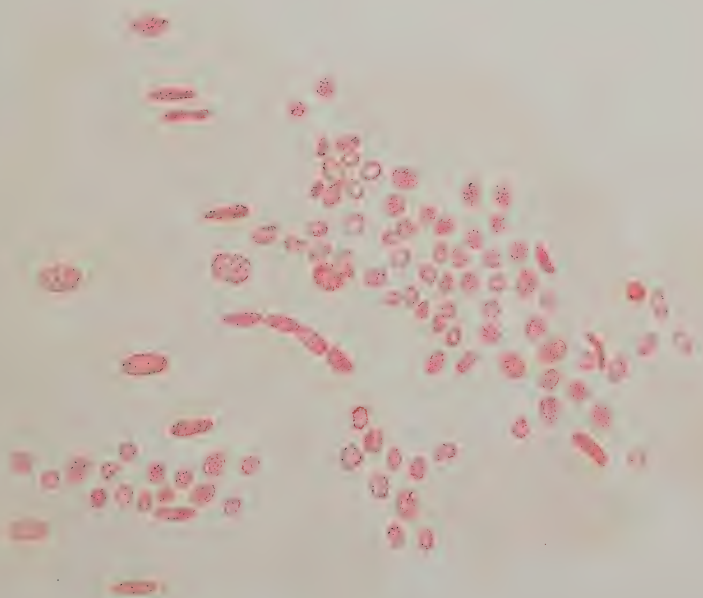


Fig II



figures were found in these large cells. Diplococci were only found associated with the presence of the leucocytes and fibrin.

A rabbit was inoculated from the fibrinous exudation in the intercostal muscles, a small portion of the muscle being placed beneath the skin of the back of the animal. An acute swelling developed at this place, but there was no distinct abscess formation. The animal in the course of the next few days lost some flesh, but it continued to eat comparatively well until it was killed ten days after the inoculation. There was a large subcutaneous swelling at the point of inoculation, which had extended from this in all directions, especially downwards on the side where the inoculation was made. The entire subcutaneous tissue of the abdomen was swollen and infiltrated with a dense fibrinous exudation. Here and there in this exudation were softer places from which a thick tenacious pus could be squeezed. The tissue in places was 1 cm. in thickness. The inguinal and axillary lymph-glands on the side of the inoculation were reddened and swollen. No bacteria were found, either in the purulent portions or in the fibrinous masses, neither on the direct examination of cover slips nor in the cultures which were made, both from the seat of the inoculation and from all the internal organs.

This case is interesting on account of its unusual extension. Practically in all cases of acute fibrinous pneumonia there is a similar fibrinous exudation on the pleura covering the affected portion of the lung, to that in the lung itself. In most cases the fibrinous exudation is not confined to the pleura immediately over the affected portion of the lung, but extends from this over the entire surface. There will usually be found a similar condition on the costal pleura, but not so marked as on the visceral. An extension of the process into the chest walls and into the mediastinal tissues from the pleura is exceedingly rare.

In this case there is no question but that the process in the chest walls is one of direct extension from the pleura. The histological examination of the tissues here was of great interest. Apparently the first change which took place in the intercostal muscle, in the myocardium, and in the fat of the

pericardium was a proliferation of the cells of the interstitial tissue. The new formation of cells appeared to have taken place from the cells of the interstitial tissue, most probably from the cells of the capillary walls or from the lymph spaces. The newly formed cells were of two sorts. There were large cells with an abundant protoplasm and a large brightly staining nucleus, and small cells similar to the lymphoid corpuscles of the blood, with a nucleus almost filling up the body of the cell. In this tissue there were no leucocytes nor fibrin. They appear to come later, and with the leucocytes and the fibrin the organisms were aways found.

ACUTE INFECTION WITH THE DIPLOCOCCUS LANCEOLATUS IN A CHILD FIFTY–SIX HOURS OLD, THE INFECTION PROBABLY TAKING PLACE AT TIME OF DELIVERY.

I am indebted to Mr. J. R. Poor, of the Harvard Medical School, for the autopsy and for the history of this case.

The mother of the child was a primipara, belonging to the criminal class. Two months before delivery an abscess of the breast had developed, following on a kick. At the time of delivery this was completely healed, leaving a stellate cicatrix. The mother was a healthy young Irish woman. Since delivery the mother has done well, with the exception of a very slight rise of temperature on the third day, apparently due to a family row. There was no respiratory trouble whatever. The birth took place at noon, May 12. The delivery was a somewhat slow one, necessitating the application of forceps. The child slightly asphyxiated at time of birth. The respiration was rather slow, necessitating hot and cold application. No trouble noticed in the child until the 14th, forty-eight hours after delivery: then it appeared to be rather dull and slightly cyanosed. It died suddenly at seven P.M., fifty-six hours after delivery. Before death vomited slightly.

Autopsy made twelve hours after death. Male child, large and well formed. Posterior to the right ear there is a large ecchymosis made by forceps. A very slight hemorrhage in the dura, on the right side, corresponding to the external ecchymosis. The brain is normal. In the peritoneal cavity

there is a small blood-clot. No adhesions. In the anterior mediastinum there is a slight amount of hemorrhage, the thymus glands being especially infiltrated with blood. In each pleural cavity there is a slight amount of hemorrhagic exudation. The pleural surface of the right lung over the lower lobe shows in places a fine fibrinous exudation. The entire lower lobe of the right lung completely consolidated. The lower portion of the upper lobe also consolidated. The pleural surface of the lung sprinkled with fine ecchymoses. The consolidated lung is of a dark-red color, looking somewhat like a hemorrhagic infarction. On section it is dark red. The cut surface is dry and smooth. The granular appearance of an ordinary croupous pneumonia is absent, but the lung is not so smooth as it would be in a purulent or hemorrhagic consolidation. The bronchi contained bloody mucus. The left lung shows almost the same condition as the right. Consolidation complete in the lower lobe and in a considerable portion of the upper. In the pericardial cavity there is a considerable quantity of slightly opaque serum. The visceral pericardium sprinkled with shall hemorrhages, which are also seen in the myocardium.

The valves of the heart normal. The ecchymoses are not only found in the pericardium, but extend from this into the muscular tissue of the heart, and especially into the intraventricular septum. In the trachea there is a quantity of blood-stained mucus. The pharynx and œsophagus are normal. In the stomach there is a considerable amount of dark blood. The liver large, rather pale, and on section there are numbers of opaque slightly reddish foci of an average size of $\frac{1}{2}$ mm., which contrast sharply with the surrounding parenchyma. The spleen is large. On section homogeneous, rather soft. Neither malpighian bodies nor trabeculæ are visible. No abnormal condition found in the other organs.

Cover slips made from the lungs show enormous numbers of typical diplococci with well-defined capsules. Similar organisms were found in the blood from the heart, and in the scrapings from the other organs. Cultures made from the organs gave pure cultures of diplococci from the lungs, heart, blood, liver, spleen, and kidneys.

A rabbit inoculated with scrapings from the consolidated lung died in three days of typical diplococcus septicæmia.

Examination of the consolidated portions of the lung showed an absence of typical appearance of fibrinous pneumonia. The consolidation was almost entirely due to hemorrhage into the lung. In places there were small amounts of fibrin. Usually this was mingled with the red corpuscles, but in some places it was found in the alveoli almost alone. Here and there a few leucocytes were found along with the red corpuscles, but the numbers of these were exceedingly scanty. There was everywhere hyperæmia of the vessels, and as far as could be ascertained by the examination of the cross sections of the larger vessels, there was no leucocytosis. In many portions of the lung the appearance resembled that of the fœtal lung. The mucous membrane of the bronchi in these places was convoluted and the alveoli imperfectly expanded. Diplococci were everywhere present in enormous numbers. They were found not only in the hemorrhagic exudation within the alveoli, but were also present in the alveolar walls and in the cross sections of the larger blood-vessels. Fresh sections made of the various organs at the time of the autopsy showed no abnormal condition.

This case is of especial interest from the early age of the child, and the character of the infection produced by the diplococcus lanceolatus. In this case there was a general infection of the entire organism, similar to that which is usually produced in rabbits by inoculation with virulent cultures of the diplococcus. In spite of the early age of the child, it is not at all probable that the infection took place in utero. The mother was absolutely free from pneumonia or from any other pathological condition at the time of birth.

Welch has gone over carefully in his paper on the diplococcus lanceolatus all of the cases which have been reported of intra-uterine infection of the fœtus. In most of these cases death of the infant has taken place two to five days after birth; and although the infection was probably intra-uterine, the possibility of this having taken place during or after birth cannot be absolutely excluded. The most satisfactory of these cases is that reported by Birch-Hirschfeld. On the fourth day of a fibrinous pneumonia, the mother

gave birth to a seven-months still-born fœtus with intact membrane. There were hemorrhages in the maternal and middle parts of the placenta. The only lesion noticed in the fœtus was ecchymosis in the pelvis of the kidney. Typical diplococci were found by culture in the liver, heart's blood, and umbilical vein.

It is well known that acute fibrinous pneumonia developing during pregnancy is likely to bring about miscarriage. This is the case not only in human beings, but in mice and rabbits which have been inoculated.

The character of the exudation in the lungs was also of interest. The exudation in the lungs was to a large extent hemorrhagic in character, and the condition most resembling that produced by the organisms in the adult was the fibrinous exudation on the pleura. There can be little doubt from the extent of the lesions in the lung that the organisms had entered the lungs first, and probably at the time of birth. The artificial respiration carried on may have been responsible for the entry of the organisms into the lungs.

The two cases also show a marked contrast, not only in the character of the lesions in the human cases, but also in the character of the lesions produced in the animals. In the first case there was a marked tendency to a local extension of the organism, with the production of a typical fibrinous exudation wherever it was found. The same thing was seen in the rabbit which was inoculated with the exudation.

These varying effects which are produced by inoculation with the diplococcus lanceolatus are probably to be referred to especial differences in the action of the organisms, and not to a mere difference in the degree of virulence. Cultures of the pneumococcus are sometimes met with which will always produce in every generation the same definite lesions.

VIII.

A CASE OF SUPPOSED SYPHILIS OF THE HEART.[1]

By W. T. Councilman, M.D.

The patient had been well until eight years before entering hospital. Had gonorrhœa four times, last time four years ago. Three years ago had had a chancre, followed in six months by sore throat, deafness, and falling out of the hair, and one year later had had an eruption of the skin. The patient has been a steady drinker of whiskey for several years. His present illness began three years ago with dyspnœa and cough, followed by œdema of legs. He was in the Hospital three months ago, and was somewhat relieved by treatment, but the symptoms returned later. His appetite was poor, and there was frequent regurgitation of food. Diarrhœa and pain in abdomen for past three weeks. On admission, there was marked cyanosis of face, lips, and hands. Pulse very irregular and feeble. Respiration rapid and labored, with orthopnœa. The apex beat of heart 1½ inches outside nipple line. No murmur heard. Great pulsation of vessels of neck. The posterior bases of both lungs shows evidence of œdema. The abdomen somewhat distended. Dulness in both flanks. The liver dulness extends to within two inches of the umbilicus. The edge of the liver is smooth and plainly felt. In the extremities there is marked œdema of both legs. An ulcer the size of a twenty-five cent piece on right leg, and cicatrices from old ulcers on both legs. Numerous small cicatrices over skin. Urine is acid, specific gravity 1022, contains a large amount of albumen, slight amount of sediment. Under the microscope contains pus cells, blood, and hyaline casts. The patient gradually sank,

[1] This case died at City Hospital in the service of Dr. C. F. Withington, to whom I am indebted for the clinical notes.

and died three days after entry into the Hospital, all the conditions becoming worse.

Autopsy September 28, twelve hours after death.

The body strongly built, muscular. The superficial veins in right leg dilated with hard nodular swellings along their course. A large ulcer just over ankle, with chronic indurated edges. Very slight œdema of lower extremities.

The abdomen distended. In the right inguinal region there is a cicatrix with indurated tissue about it. The inguinal glands enlarged. The penis is œdematous. There are two small superficial ulcers in the foreskin, with irregular necrotic edges. The glans penis immediately around the meatus is indurated and the mucous membrane is eroded.

The face and posterior surface of body is intensely congested. Over the entire body there is a slight papular eruption. The subcutaneous tissue is œdematous. The veins of neck enlarged and dilated. In the abdominal cavity there is a large amount of clear serum. The peritoneum is smooth. The entire cæcum is freely movable for a space of 12 cm. Liver and spleen free from adhesions. Diaphragm on right side at seventh rib; on left, at lower border of sixth rib.

In the right pleural cavity there are two litres of clear serum; a smaller amount in the left. The lower corner of the left lung is firmly adherent to the pericardium. The mediastinal tissue is somewhat thickened and infiltrated with gelatinous œdema. The pericardial space uncovered by lung 14 × 14 cm. The pericardial cavity is obliterated.

The heart weighs, together with the attached pericardium, 930 grmms. All the cavities, especially those of the right side, enormously dilated, and contain fluid blood and fresh dark clot. Circumference of tricuspid valve, 15½ cm. Circumference of pulmonary artery just above valve, 9 cm. Circumference of mitral, 12 cm.; of aorta, 8 cm. Length of left ventricle, 9½ cm.; of right, 11 cm. Left ventricle, 2 cm. thick; right, 8 mm. In the descending branch of the left coronary artery, at a point 4½ cm. from its origin, the lumen of the artery is slightly narrowed and the intima thickened. This is directly opposite a branch of the artery passing down into the septum. Throughout the right ventricle, which is enormously dilated, there are areas of fibrous myocarditis.

This appears in the formation of masses of firm whitish-yellow tissue, which in places almost entirely substitutes itself for the muscular tissue. These areas of greater or smaller size are scattered over the entire ventricle. They are most marked close beneath the surface of the adherent pericardium, and appear to extend from this into the myocardium. There are similar, but smaller, patches in the left ventricle. The left lung is slightly adherent to chest wall by old adhesions. The lymphatics over surface of lung injected. On section the lung is of a light-red color. Consistency of the lung greatly increased. In the bronchi there is a small amount of muco pus. Mucous membrane of bronchi intensely congested. The pulmonary arteries dilated. The right lung compressed by pleural exudation. In the apex the pleura is thickened, contracted, and the lung puckered beneath it. On section at this point radiating bands of connective tissue extends from the thickened pleura for some distance into the lung.

Liver large, weight 2070 grmms. Capsule slightly thickened. Over the surface there are numerous very small whitish shreds of connective tissue. The acini marked out by central injection. Gall-bladder slightly distended. Bile-ducts normal.

Spleen is large; weighs 450 grmms. Capsule slightly thickened. On section firm, of a dark-red color; trabeculæ prominent. Pancreas and adrenal glands normal.

Both kidneys distinctly enlarged, weight of right 220 grmms. Both of the same size and general appearance. The capsule is very slightly adherent. On its removal a very small amount of renal tissue is in places removed with it. The surface of the entire kidney is congested. The markings are normal. Cortex of normal thickness. Malpighian bodies injected and prominent. Mucous membrane of entire canal congested and œdematous. In the descending colon there are numerous diverticulæ.

Both testicles are small. The tunica vaginalis thickened. On section there are whitish masses of fibrous tissue extending into the organ from the tunica, in places entirely substituting itself for the gland.

The scalp unusually adherent to skull. The skull thick,

especially over anterior and posterior portions. The dura mater extremely adherent. Inner meninges somewhat cloudy and œdematous; easily stripped off. Brain slightly œdematous. Convolutions and cranial nerves normal.

The aorta and the larger arteries of the body smooth and free from lesions.

ANATOMICAL DIAGNOSIS.

Chronic fibrous myocarditis. Localized thickening of left coronary artery. Heart dilatation and hypertrophy. Bilateral hydrothorax; ascites; adherent pericardium; general chronic passive congestion. Slight chronic diffuse nephritis. Chronic interstitial orchitis. Papular (syphilitic) eruption of the skin. Syphilis.

Microscopic examination of the myocardium shows a general interstitial growth of connective tissue with atrophy of the muscle cells. The increased connective tissue is rather more marked on the right side of the heart. Here it extends a variable distance from the pericardium into the myocardium. In some places only the most superficial portions of the myocardium immediately beneath the pericardium are affected. In others it extends throughout the entire thickness of the ventricle, in some places substituting itself entirely for the muscular tissue. In some places there is an abundant formation of round cells in the interstitial tissue, giving the tissue the appearance of granulation tissue. This is especially marked where the process seems to be advancing most rapidly. In other places it contains few cells, and has the general characteristics of cicatricial tissue. The muscle cells of the heart imbedded in this tissue show various atrophic changes. They are very small, the nuclei have disappeared, and the fibres appear simply as more or less hyaline masses, staining brightly with eosin. There is the most marked change in the arteries in the areas of myocarditis. In all of these there is an intense endo and peri arteritis. The tissue producing the thickening of the intima extends homogeneously along the entire wall, being more marked in some places than in others. There are no distinct lesions of the muscular coat, such as we are accustomed to find in the ordinary arterio sclerosis. The

tissue around the artery is thickened and contains closely packed round cells. This change has gone so far in some places as to lead to entire obliteration of comparatively large arteries. Interesting changes were seen in the nuclei of the muscular fibres in and about the areas of interstitial growth. This change consists in an enormous enlargement of the nucleus. On cross section the fibre contained an irregular mass in its centre, with the characteristic nuclear stain, sometimes almost filling up the entire muscular fibre. On longitudinal section of the fibre these nuclei were enormously increased in length. The change appeared to be a degenerative one, and no evidence of cell multiplication in the muscular fibres could be obtained.

Examination of the thickened area in the branch of the descending artery shows a circumscribed endarteritis, with a marked degree of thickening of the intima, and a small cell infiltration extending throughout all of the coats of the artery.

Microscopic examination of the liver and kidneys gave little of interest. In the liver there was a slight interstitial hepatitis consisting in a slight increase of the portal tissue, with diffuse round-cell infiltration extending into the lobule. No endarteritis could be made out in the organ.

In the kidney there was a very slight diffuse nephritis, with an increase in the interstitial tissue close beneath the capsule. There was well-marked passive congestion. The vessels in some places showed an extreme degree of congestion. No lesions of any importance could be made out in the epithelium nor in the glomeruli.

In the testicles there were the characteristic lesions of the interstitial syphilitic orchitis. An extreme degree of interstitial growth, evidently proceeding from the tunica vaginalis, extended through all parts of the tissue. In some places it had substituted itself entirely for the glandular tissue. In other places it was only slight in amount. The epithelial tissue of the testicle showed all degrees of atrophy. In some places the epithelial cells had disappeared entirely, leaving only masses of hyaline tissue which represented the thickening of the membrana propria. Throughout the testicle this thickening of the membrana propria was evident.

In all of the arteries there was a similar condition of extreme endo and peri arteritis similar to that found in the heart. There was no evidence of amyloid infiltration in any of the organs.

This case is of great interest from the extent and character of the lesions in the heart. The formation of fibrous tissue was more diffuse and extended over a greater area of the heart than is usually met with. Fibrous myocarditis cannot, in general, be regarded as a rare condition. It follows on all local degeneration of the myocardium which may be due to interference with the blood supply, or to other causes, and is most commonly associated with disease of the coronary arteries. In cases of adherent pericardium there may be a very small amount of connective-tissue formation in the superficial portions of the muscular tissue, but this never reaches any very considerable extent.

In this case there was no general affection of the coronary arteries, and all of the arteries of the body, both on macroscopic and microscopic examination, were normal, with the exception of those in the heart and testicles. It is very probable that in this case we must regard the condition as syphilitic, and due to a localized syphilitic endarteritis of the smaller branches of the coronary arteries.

Syphilis of the heart may be regarded as an extremely rare condition. The subject has lately received a very careful treatment by Mracek (Arch. f. Dermat. u. Syph. 1893). He has gone over the entire literature on the subject, and has collected a great many cases, most of which he regards as doubtful. He has found five cases in the general hospital of Vienna. The most common form of syphilitic disease of the heart, and the most certain, is one connected with the formation of gummata. These gummata may be formed in the myocardium, or can extend into this from the pericardium. In some cases they appear to have taken their origin in the endocardium, and to have extended from this into the muscular tissue. Rupture, or aneurism formation, can follow as a result of degenerative changes taking place in the gummata. Virchow rather doubts the presence of a diffuse syphilitic inflammation of the heart without the formation of gum-

mata. Mracek thinks there is no doubt that chronic fibrous myocarditis with the formation of cicatritial can be produced by syphilis, and gives a number of such cases from the literature.

Orth, in speaking of connective-tissue formation in the myocardium, says that everything which can lead to narrowing or obliteration of the coronary arteries may be regarded as causes for cicatritial formation in the heart. Since both alcohol and syphilitic virus may be the cause of endarteritis, they may also be the primal cause of connective-tissue formations in the heart. In the case in question syphilis would seem to be indicated both from the absence of any general disease of the vessels and from the extent to which the adventitia of the vessels was involved in the local process. In the ordinary forms of endarteritis, making a part of the general arterio sclerosis, the adventitia is little, if at all, affected. The new formation of connective tissue takes place almost entirely from the intima, and in most cases appears to result from degenerations of the muscularis. While the heart lesions, in the absence of definite gummata, cannot be regarded as certainly due to syphilis, it must be regarded in connection with the well-marked lesions in the testicle of a similar character, which are certainly to be referred to syphilis, as very probably of syphilitic origin.

IX.

OBSERVATIONS ON THE KIDNEYS IN A CASE OF PUERPERAL ECLAMPSIA.

By W. T. Councilman, M.D.

M. L., a Primipara. — Present attack began three days before entry into the Hospital, with general pains, headache, nausea, and vomiting. During the entire pregnancy, previous to this attack, the general condition was good. Two days later the patient went to bed, and shortly afterward was found on the floor in a convulsion. She was unconscious when brought to the Hospital in the ambulance, and had three convulsions immediately after entering into the Hospital. Six ounces of urine, drawn with catheter, showed from $\frac{1}{8}$ to $\frac{1}{4}$ per cent. albumen.

Physical examination showed an abdominal tumor extending from the pubes to four inches below ensiform cartilage. Pupils somewhat dilated. Very slight œdema over tibiæ; completely unconscious.

Vaginal Examination. — Cervix Patulous. — The internal os slightly dilated, showing that labor had begun. A severe convulsion followed immediately after examination. After anæsthesia the os was dilated and labor completed. A well-developed live child was delivered. The placenta was delivered fifteen minutes later. The patient was given a hot-air bath and an eighth of a grain of pilocarpine, which was followed by a moderate sweat. Two convulsions took place, one shortly after the other, and in spite of a temporary rally the patient died. Autopsy, twelve hours later.

The heart and lungs showed no change beyond extensive œdema of the lungs. The kidneys slightly swollen. Both of the same size and general appearance. On stripping off the capsule, very small portions of renal tissue were

in places detached with it. The surface otherwise smooth, and paler than normal. Here and there small opaque, whitish foci were seen. On section the cortex was slightly swollen, of a grayish-white color, and somewhat opaque. The markings of cortex were obscure. The glomeruli faintly visible and pale.

The weight of the liver was 1,245 grmms. Peritoneal surface smooth and of a pale reddish-brown color. On section there was some hyperæmia of the centre of the nodule. The liver was of normal size and weight. The gall-bladder contained a small amount of dark yellowish viscid bile. No alteration was found in any of the other abdominal organs.

The mucous membrane of the intestinal canal somewhat congested. The uterus was large and of the normal appearance of a uterus at the end of pregnancy.

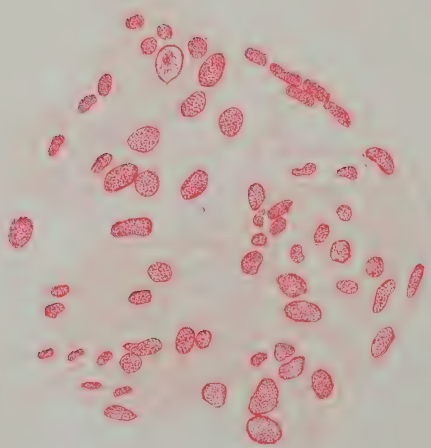
Microscopic Examination. — Sections of the fresh organs showed an extensive fatty degeneration of the kidneys and liver. There was slight fatty degeneration of the myocardium with parenchymatous swelling.

Bacteriological examination of the organs showed the presence of colon bacilli. They were found in the greatest number in the kidneys and in the lungs.

Unfortunately, only portions of the kidneys were saved for examination. These were hardened both in Flemming's solution and in alcohol. The sections of the portions hardened in Flemming's solution gave the best results. The sections to the naked eye showed no alteration. With the low power there appeared here and there over the cortex, close beneath the capsule, very small ingrowths of connective tissue, evidently due to a slight degree of chronic nephritis. The tubules appeared dilated and filled with a more or less granular mass. The glomeruli were large, completely filling the capsule. On examination with a high power there was more or less fatty degeneration of the epithelium. This was most marked in the smaller collecting tubules. The epithelium of these in places was not only filled with cells, but here and there broken down and disintegrated. The convoluted tubules in general showed both granular and fatty degeneration, but this was much more

Fig III

Fig IV



marked in some places than in others. There were foci evidently corresponding to the opaque spots found on microscopic examination, in which almost all of the convoluted tubules contained some fat. The fat was almost entirely confined to the periphery of the cells, close to the membrana propria. The size of the fat drops varied: in some places they were large, in others very fine. The epithelium of almost all of the tubules was swollen. The cells were filled with granules, varying somewhat in size and in appearance. Here and there the swelling was very well marked, and was due to the presence of larger hyaline granules in the cells. (Fig. III.) In some places the tubules contained the same droplets of hyaline material which were found in the cells, and in these places the cells had lost their outlines, and the contents of the cells were in direct continuity with the material in the lumen of the tubules.

The glomeruli with the low power showed no change. Examined with the high power many of them showed a considerable degree of alteration. In nearly all of them there was more or less fat. (Fig. IV.) The fat appeared in the form of single granules; usually a larger granule with several smaller ones in its immediate vicinity. These were scattered irregularly over the glomerulus. In some places it could be definitely made out that the fat was contained in the covering epithelium of the capillaries. In others it was contained in the capillary walls. In general, the glomeruli appeared indistinct. The sharp contours of the capillaries, which can be so well made out in the thin sections of the kidney after hardening in Flemming's, were obscure. In many places portions of the glomerulos were found in which the capillary loops were fused together into a more or less indistinct mass. In places not so much altered the lumen of the capillaries was diminished to a marked degree. This was in part due to swelling and hyaline degeneration of the capillary wall. In other places the capillaries contained granular detritis and broken-down cells. In a few loops there was a marked increase in the nuclei of the capillaries. All of the glomeruli showed more or less alteration, but in some it was much more marked than in others. In the pyramids of the kidney there was a few foci of interstitial

growth, similar to those in the cortex, and evidently due to the same cause. A careful examination of the vessels of the kidney showed no alteration.

The cause of puerperal eclampsia is one which has always been involved in a great deal of obscurity. Lever, in Guy's Hospital Reports, 1843, was the first to call attention to the presence of albumen in the urine in cases of puerperal eclampsia. After this almost the entire attention of the clinicians and pathologists was turned to the kidneys. In the great majority of cases, more or less marked lesions were found in these organs; but in few cases were there any lesions which could be regarded as chronic, nor were the acute lesions sufficiently well marked to explain the disease. Still, in general, the puerperal convulsions have been regarded as a phase of uræmia. The lesions generally found in the kidney consist essentially in degenerative processes, cloudy swelling, fatty degeneration, and necrosis of the epithelium of the convoluted tubules. In a number of cases dilatation of the ureters and pelvis of the kidney was found. This condition was evidently due to pressure on the ureters exerted by the pregnant uterus.

There have been numerous theories advanced to account for the renal lesions in pregnancy. None of them have been found sufficient. Almost all of the theories advanced have referred in some way the renal lesions to the increased abdominal pressure produced by the pregnant uterus. In some cases it has been referred to a general increase in abdominal pressure; in others, to a pressure expressly exerted on the renal veins; in others, again, to a damming back of the urine from the pressure on the ureters. All of these explanations have been unsatisfactory. Similar lesions in the kidney are not produced in other cases in which there is an increased abdominal pressure, as by the pressure of tumors, etc.

Of late another theory has been advanced to account, not only for the renal lesions, but for the general pathology of puerperal eclampsia. Attention has been called to changes in other organs. The first organ other than the kidneys which was found to be affected in cases of puerperal eclampsia was the liver. Jurgens was the first to call attention to

a form of hemorrhagic hepatitis which was constantly present in puerperal eclampsia. He was also the first to show that in this condition liver cells frequently entered into the blood circulation and were carried away as emboli by the circulating blood. This was afterward confirmed by Klebs in two cases of eclampsia in which extensive lesions of the liver were found. Pilliet, in 22 cases of eclampsia, investigated these conditions still further, and gave an exact histological account of them.

The whole matter of puerperal eclampsia has lately been materially cleared up by a work of Schmorl. Schmorl has found constantly in this condition lesions in the liver consisting of extensive necroses with hemorrhage and destruction of the liver tissue. In some of his cases the tissue was so altered, and there was such a degree of destruction, that the liver closely resembled that of acute yellow atrophy. He thinks it is possible that some of the cases of acute yellow atrophy which have been described as arising in the puerperal condition could be referred to such lesions of the liver. He not only found liver cells in the branches of the hepatic vein, but he found them also in other organs where they had been carried by the blood stream. They were found in the lungs and kidneys. In the kidneys these emboli of liver cells were only found in the small veins, and he thinks that possibly the cells were carried to the liver by retrograde embolism. In his examination of the lungs very important lesions were found which consisted more particularly in the presence of giant cells in the branches of the pulmonary artery. He was also able to find liver cells in the blood on the right side of the heart, and in the blood taken from the pulmonary artery. These large cells which he finds in the pulmonary vessels he thinks without doubt come from the placenta, and lesions of this must be held responsible for them. He has made out, as a general result of his investigations, that the lesions in all the organs consist of foci of degeneration and necrosis. Sometimes this is associated with hyaline thrombis in the vessels. The general cause of the condition, he thinks, must be referred to an absorption of ferments produced in the placenta.

Still another hypothesis refers to the origin of puerperal

eclampsia to the action of micro-organisms. The anatomical lesions which are found do not speak against this assumption, since in other diseases of infectious origin lesions of the same character may be made out. Doleris, in 1886, was the first to express this view. Blanc also defended it, and isolated a short bacillus from the urine of women with eclampsia. On injecting this bacillus into animals he produced convulsions, and he regarded it as the specific agent of eclampsia. He did not make any cultures of the blood or of the internal organs. Favre examined bacteriologically two placentas from women with eclampsia, and isolated three different organisms from these organs. He believes that each one of these micro-organisms could, under favorable conditions, produce eclampsia. He holds the view that in these cases there is an endometritis, before the pregnancy, and micro-organisms enter into the placenta, producing various changes in this, especially the white infarctions, and by their ferments produce a nephritis.

As long as the kidneys are capable of function they are able to get rid of the ptomanes from the placenta, and also any micro-organisms which may enter into them, and ward off a general infection; but as soon as the function of the kidney is disturbed in any way, an accumulation of micro-organisms or of their chemical products can take place in the body, and then the symptoms of eclampsia appear.

Gerdes, in two autopsies in cases of eclampsia, found a bacillus in the organ in each one of the cases. The autopsies were made a considerable time after death; in one case 33 hours, and in the other 14. As the result of this, Gerdes held that these bacilli were the sole cause of the eclampsia, and without the bacillus there could be no cases of eclampsia. He inoculated mice and other animals with the bacillus, and succeeded in producing convulsions in them.

Hofmeister investigated the organisms found by Gerdes, and identified them with the proteus vulgarus. He also made numerous culture experiments on placentas derived from cases of eclampsia and from the organs after death, and in most cases obtained only negative results.

Schmorl investigated thoroughly all the cases of eclampsia seen by him with regard to micro-organisms, and was

not able to obtain any organisms which he could regard as of specific character. The most common organisms found were bacilli, which could certainly be regarded as saprophitic in character. In a few cases in which there were advanced inflammatory lesions in the external genitalia or in the cervix of the uterus, pus organisms were found in the tissues. Lubarsch made a number of bacteriological examinations, and obtained the same results as those of Schmorl.

In our case colon bacilli were found on culture in all of the organs. But it would be too much to add this disease to the weight of guilt which is already laid on this poor organism. From what is at present known of the colon bacillus, it seems to be probable that in a number of cases invasion of the tissues takes place from the alimentary canal. This is nearly always found when there are any lesions of the alimentary canal, and is apt to be found when death takes place slowly and the resistance of the tissues is lowered.

It is greatly to be regretted that an unfortunate accident prevented a careful study of all of the organs in the case.

X.

A CASE OF LIGATION OF BOTH COMMON CAROTID ARTERIES FOR DOUBLE ANEURISM. RECOVERY.

By George W. Gay, M.D.

The following case of aneurism of the carotid artery upon both sides of the neck is thought worthy of a permanent record. Double aneurisms in any part of the body are rare. Ligation of one common carotid is not very infrequent, but that operation performed upon both vessels successfully is certainly an uncommon event, even in the large hospitals. It was impossible to find the details of a single case since 1880 in the available medical literature.

When Mr. A. was 7 years of age a small pulsating tumor was noticed upon the left side of the neck about an inch above the clavicle. It grew slowly, gave no trouble whatever, and received no treatment.

Ten years later, *i.e.*, at the age of 17, a small bunch the size of a chestnut made its appearance in the anterior triangle of the neck on the right side, upon a level with the top of the thyroid cartilage. This tumor pulsated, changed very little, gave no trouble, and, like its fellow upon the opposite side, received no particular attention. No cause, as of traumatism, could be assigned in either case.

This patient came under my care in July, 1892. He was then 26 years of age. His appearance indicated as good health as could be expected in any one who worked in a shop continuously. Aside from the tumors in the neck he considered himself well. His habits and family history were good. No evidence of tubercular or specific disease. Weight about 140 pounds. Temperament calm, fearless, and courageous.

Upon the left side of the neck was an oblong smooth

pulsating tumor extending from a point an inch and a half above the clavicle to the mastoid region, filling all of the upper part of the anterior triangle, and raising the sterno-mastoid muscle, as well as crowding it backwards. No bruit could be detected, but the pulsation expanding the tumor in all directions was very apparent. The growth had been more rapid during the past year than ever before. Lately he had experienced some difficulty in swallowing, probably owing to the size of the tumor, but none in breathing or talking. A slight frontal headache had troubled him for a month. Pressure upon the carotids below the tumors stopped the pulsation in both aneurisms.

The tumor upon the right side was situated at the bifurcation of the common into the external and internal carotid arteries, opposite the upper border of the thyroid cartilage. It was about an inch in diameter and distinctly pulsating. There was also a distinct bruit. The skin overlying it was free from induration and discoloration.

No difference could be detected in the pulsation of the temporal arteries upon the two sides. The heart sounds were normal, unless a "slight accentuation of the second sound" be excepted. No difference in radials, and there were no disturbances of the head or upper portion of the body referable to the nervous or circulatory systems. Superficial arteries were not calcareous. The first operation was done July 30, 1892. An incision was made over the tumor upon the left side of the neck extending upwards from just above the clavicle. A careful dissection was carried down to the common carotid between the aneurism and the clavicle. Two braided silk ligatures were applied to the artery about half an inch apart, and the vessel was divided between them. The lower end of the artery retracted somewhat; the upper could not do so owing to the firm and extensive adhesions of, and its proximity to the aneurism. Pulsation in the tumor ceased upon tightening the ligatures. The wound was closed with silk sutures, and a baked dressing applied. It is needless to say, that careful antiseptic precautions were taken throughout the operation.

The patient bore the operation well without shock. No headache, dizziness, or other disturbance of the nervous

system followed. The wound was dressed in six days for the first time, and found united by first intention. The patient sat up in two weeks, and left the Hospital in three weeks in good condition. There was no pulsation in the tumor. No efforts were made to open or to remove the aneurismal sac at the time of the operation, as from its size and location such a proceeding would have prolonged the operation beyond reasonable limits, and would have jeopardized his recovery. It was thought best to leave it to be absorbed. The result justified the decision. The patient soon resumed his work, and followed it, till it was decided to attack the remaining tumor.

On June 13, 1893, ten and a half months after the first operation, the second was performed upon the opposite side. The aneurism had increased very perceptibly during the interval between the operations, it being now the size of a pullet's egg. Ether was administered without any difficulty upon both occasions, and was borne well. The right common carotid artery was tied in precisely the same manner as was the left one, described above. The ligature was applied about two inches above the clavicle on the right side, and from an inch to an inch and a half above on the left. The artery was divided between the ligatures, and the wound was closed with silk sutures, and covered with baked gauze, cotton wadding, and figure-of-eight bandage.

The shock following this operation was moderately severe, but not alarming at any time. It was doubtless somewhat increased by a mishap, which occurred during the operation. One of the deep veins, probably the internal jugular, was accidentally wounded with the director, giving rise to a troublesome hemorrhage. Not much blood was lost, but the field of operation was greatly obscured. The bleeding was controlled with deep ligatures of silk, and the operation was completed. On coming out of the anæsthetic it was found that the patient's voice was very hoarse, and it was with difficulty that he could speak above a whisper. An examination with the laryngoscope showed paralysis of the right vocal cord. This was probably due to an inclusion of the right recurrent laryngeal nerve in the ligature applied to the vein.

The sutures were removed in four days. The wound healed by primary union. The man was up and dressed in thirteen days. No cerebral symptoms whatever were noticed after either operation. Three weeks after the last one, the laryngologist, Dr. Farlow, reported as follows: "Fixation of right vocal cord near the median line, limitation of motion of the left vocal cord, and swelling and redness of the arytenoids." The voice steadily improved, and three months later it was natural, and as strong as ever, except he tried to shout, when it was rather weak.

The small bunch upon the right side had entirely disappeared in about four months. The large tumor upon the left side of the neck slowly diminished after the ligation of the left carotid, until it was scarcely noticeable to sight at the time of the second operation, about a year later. Four months after the last operation — that is, the one upon the right side — a small pulsating tumor made its appearance apparently in the centre of the sac upon the left side. The pulsation was distinct, but not forcible, and was very likely due to a dilatation of some anastomosing vessel. The patient has been advised to have this secondary aneurism excised. This would seem to be a feasible procedure, from the fact that it is small, about three-fourths of an inch in diameter. No pulsating vessel can be felt in its vicinity, hence a direct attack would necessarily be the proper course to pursue.

From the history of the case and the location of the tumor, I conclude that the aneurism upon the left side had its origin in the common carotid artery. At all events, about one-half of that vessel was dilated and involved in the tumor. The origin of the tumor upon the right side was evidently not in the common carotid, but either at its bifurcation, or in the external carotid.

The following are some of the peculiar features of this case: aneurisms of the large vessels upon both sides of the neck; the early age at which they made their appearance — seven and seventeen years respectively; the obscure cause, the slow growth, the freedom from disturbance of the nervous or circulatory systems, the rapid recovery after operation, the uneventful convalescence after each one, and the

excellent condition of the patient at the present time, as regards his general health. It is now nineteen months since the last operation was performed, and the patient is at work at his trade, as a dental instrument maker. The secondary aneurism upon the left side increases very little, if at all, and gives him no trouble whatever. Aside from this he is perfectly well.

That ligation of both common carotids is a rare operation is shown by the fact that Dr. C. M. Whitney, surgical registrar of the Boston City Hospital, was able to find allusion to but one case since 1880. That was by Reigner, "Concerning a double aneurism of the common carotid cured by ligation of both carotids." Breslau, Ztschr., 1884, Vol. vi. 222–4. A careful and prolonged search through the medical literature of the past thirteen years has failed to reveal the particulars of this case.

In Pilz's table[1] of 600 cases of ligature of common carotid for all causes, the operation was performed upon both sides in 27 instances, with 20 recoveries. Erichsen gives the following conclusions:

First, that ligation of one common carotid is followed by cerebral disease in more than one-fourth of the cases, and that one-half of these so affected are fatal.

Second, that ligation of both common carotids, with an interval of some days or weeks, is not more frequently followed by cerebral disturbance, than when only one of the vessels has been tied.

Ligation of the common carotid for various causes is not an uncommon event at the present day. So far as I know, the first successful operation in this country was performed by Dr. Amos Twitchell, of Keene, N.H., on Oct. 18, 1807. It was done for secondary hemorrhage following an extensive gunshot wound of the neck, ten days after the injury. The skill and courage of this surgeon is shown by the fact that the operation was done in an emergency, without preparation, and with no assistance except that rendered by the patient's mother. The doctor had finished the dressing of the wound, and was about to leave the house, when some one called to him that the patient was bleeding. He

[1] Erichsen, Science and Art of Surgery, 1885, vol. ii. p. 585.

hastened to the bedside, removed the bandage, and stopped the hemorrhage temporarily by direct compression with his finger. With the use of only one hand, and what aid the old lady could give, he made an incision downward over the common carotid, exposed the vessel, and directing the woman to wax some thread, applied and secured the ligature. As this did not completely control the hemorrhage from the collateral branches, he carefully packed the wound with small sponges, and in that way succeeded in stopping the bleeding. The patient recovered, and lived for years afterwards.[1]

Sir Astley Cooper was the first surgeon to tie this artery for aneurism, in 1805. This case terminated fatally, but a second operation performed by him in 1808 was successful.

The more common seat of aneurisms of the large vessels of the neck is at or above the bifurcation of the common carotid. Crisp gives only 25 cases of affection of the main vessel out of a total of 551.

Ligation of the common carotid artery for aneurism is a fairly satisfactory operation. Wyeth[2] records 106 cases of proximal ligation; 69 recovered. Mortality, 35 per cent. In operations for aneurism of the common carotid alone, the death-rate was 44 per cent.

Jacobson, writing in 1889, says that the mortality of the ligation of the common carotid is as yet high. Mr. Johnson Smith, quoting from the tables of M. Lefort (Gaz. Hebd., 1864–8), gives 21 fatal cases out of 47 operations for proximal ligation of this vessel. Barwell considers that the mortality in cases of operation for aneurism will be a little over 25 per cent. "Whichever of these estimates is correct," says Mr. Jacobson, "in the future the mortality should be much reduced by the advantages of aseptic surgery and modern ligatures."[3]

Dr. Markoe gives a table of 72 cases of cervical aneurisms treated by ligature of common carotid, with a mortality of 25 per cent. After comparing the results of the operation by different methods, he comes to the conclusion, that while

[1] N. Eng. Quar. Jour. Med. and Surg., vol. i. p. 188.
[2] Text-Book of Surgery, 1887, p. 217.
[3] Surgical Operations, Jacobson, 1889, p. 431.

previous to 1880 the mortality of this operation is $33\frac{1}{3}$ per cent., since that date it has been reduced to 14 per cent.[1]

During the past thirteen years only seven cases of aneurism of the common carotid treated by proximal ligation could be found in the current literature. Strange to say, every case recovered. A table of these cases is appended. A table of the unsuccessful cases occurring during this period would be interesting.

Operator.	Age. Sex.	Result.	Reference.	Remarks.	Locus.
Deaver, J. D. .	46. M.	Recovery.	Univ. Med. Mag., 1881, i., 340.	Proximal Ligature.	Right common carotid.
Karewski . . .	32. M.	Recovery.	Berl. klin. Woch., 9–909.	Proximal Ligature.	Right common carotid.
Pettus, W. I. . .	51. M.	Recovery.	Daniel's Texas Med. Jour., Aug., 1884–51.	Proximal Ligature.	Right common carotid.
Turner, G. R. .	29. M.	Recovery.	Lancet, 1892, p. 142.	Proximal Ligature.	Right common carotid.
Mills	43. M.	Recovery.	Westminster Hosp. Reports, vol. 7.	Proximal Ligature.	Right common carotid.
McGill	62. F.	Recovery.	Med. T. and Gaz., 1885, i., 711.	Proximal Ligature.	Right common carotid.
Godfrey	28. M.	Recovery.	*Ibid.*, 82, ii., 409.	Proximal Ligature.	Right common carotid.

A word may be said in relation to the method of applying the ligature. Some years ago the writer was called upon to tie the subclavian and common carotid arteries for an aneurism of the innominata. A double silk ligature was applied in both instances, and the vessel was then divided between them. In the case of the subclavian the retraction of the divided portions of the artery was so great, and so striking, that the method could but commend itself both theoretically and practically. It is very probable that union by first intention does away to a great degree with the necessity for this method, as the tissues are soundly healed in a short time, and there is neither sloughing of the vessel nor suppuration about it. In open wounds it can be readily understood that severing the vessel removes all danger from tension or other disturbance of either the artery itself or of the ligature. By this method one of Nature's hæmostatic

[1] New York Med. Jour., 1891, p. 53.

processes is thoroughly complied with, namely, retraction of the vessel within its sheath. The method certainly possesses the merit of thoroughness.

The modern method of treating wounds, whereby union by first intention is the rule, has removed the greatest obstacle to the success of ligation of arteries, namely, hemorrhage. The wound is now in most cases soundly healed before the time arrives at which ulceration and sloughing from separation of the ligature is to be expected. In fact, these processes do not occur under the latest modes of ligating vessels. Such being the fact, we may confidently look for far better results in the future than have ever been obtained in the past.

XI.

ON THE TREATMENT OF SUPPURATING BUBO; AN EXCISION; AND THE ATTEMPT TO SECURE UNION BY FIRST INTENTION OF THE WOUND AFTERWARD.

By Francis Sedgewick Watson, M.D.

I have treated twenty cases of bubo, after the method which the title of this paper describes. In two of them there were buboes in both groins, so that the number of buboes operated on was, in all, twenty-two. In ten, a little less than one-half of them, perfect union by first intention resulted.

The cases which are reported in this communication were not selected ones, but every bubo that presented itself in my service at the Boston City Hospital was subjected to the same operative treatment, except that the technique of the operations, as will be seen, was variously modified in different instances. This group of cases includes buboes of a syphilitic, chancroidal, gonorrhœal, tubercular, and traumatic nature. In all but four of the cases the skin covering the bubo was inflamed, and in some of them the inflammation had gone so far as to cause more or less necrosis of the skin. In every case there was extensive suppuration of the glandular structure constituting the bubo. In but one case (a gonorrhœal bubo) was this suppuration represented by a single abscess cavity.

The conditions, therefore, were exceedingly unfavorable to union of the wounds by first intention.

In all the operations the following rules were carefully observed:

1. To remove thoroughly all diseased tissue, and to leave,

as far as possible, a perfectly healthy surface in every part of the wound. (To secure this it is always necessary to carry the dissection down to the fascia covering the abdominal muscles; sometimes to expose the femoral vessels, and generally the external inguinal ring.)

2. To excise such portions of the skin as threatened to become necrotic or had already become so.

3. To thoroughly cleanse the under surface of the skin-flaps.

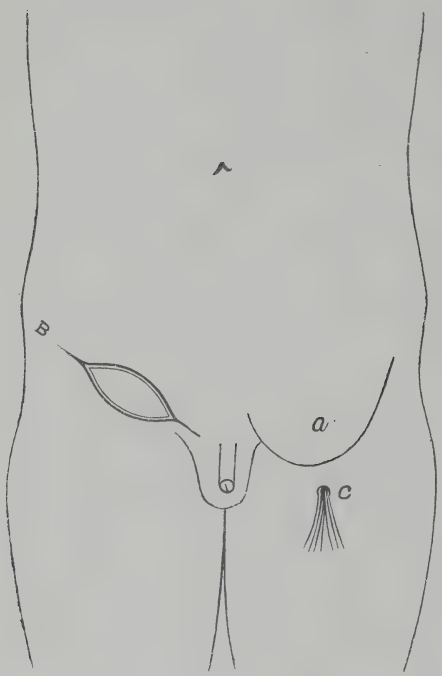
4. To thoroughly swab the whole wound with dry sterilized iodiform gauze.

In performing these operations one or two precautions should be especially observed. These are, to guard against wounding the femoral vessels and the spermatic cord, and to proceed with especial caution when dissecting about the inguinal ring, lest an unsuspected hernia be wounded. In one case a small inguinal hernia was unexpectedly exposed, upon removing a mass of firmly adherent glands that lay upon the outer aspect of the ring, and the gut narrowly escaped being wounded.

Another matter of importance, and one to which I have seen no reference made, is that of tying, as far as possible, the ends of all the lymph vessels that have been divided. In many cases these vessels are greatly enlarged, and are necessarily divided during the operation. If they are not ligated, they may exude a large quantity of fluid into the cavity of the wound, which lifts up the skin-flaps and greatly lessens the chances of securing primary union. The lumen of these vessels was in some instances large enough to admit an ordinary small-sized probe; they ramify throughout the mass of diseased glands and are intimately connected with them. They closely resemble cutaneous nerve branches, but are readily distinguished from them, in that they have a distinct lumen from which a clear fluid exudes, and are of a more yellowish color and present a duller surface.

The details of the operations were modified in the different cases according to the particular conditions presented as follows: In cases in which the skin was not at all or but moderately inflamed, one of the two following incisions was made in order to expose the bubo:

First. A crescentic cut (as in the accompanying figure *a*), carried well below the area of inflamed skin through the healthy skin. From this line a large flap was dissected up extending to a line well above the diseased glands and exposing them thoroughly. After their removal the flap was turned down again and its edge sutured on the line of the first incision. In some of these cases drainage by means of sterilized strands of silk was provided for through an opening below the line of the incision. (Marked *c* in figure.)



Second. A long incision parallel with Poupart's ligament, through the skin across the middle of the swelling. The glands being exposed by dissecting the skin from off them upwards and downwards. After removing all diseased tissue the skin wound was sutured without drainage, in some cases by a buried suture, in others by the ordinary stitch.

Of these two cuts the first is preferable, because the glands are more freely exposed by it, but especially because it offers edges of healthy instead of inflamed skin for suture and subsequent healing.

In cases in which the *skin covering the bubo had broken down* to a greater or less extent, the last of the two incisions just described was practised, but modified by dividing it toward its middle so as *to form an ellipse*, which included the area of necrotic skin, and so removed it. ("B" in figure.)

In the particular cases in which *this* incision was employed there happened to be enough sound skin to allow the

edges of the wound to be united after excising the necrotic portion. If the area of skin which has already broken down should be too large to permit this, it would be useless, of course, to attempt to secure union of the wound.

The last modification that was tried in a certain number of cases was that of *secondary suture*, the sutures being set at the time of the operation, the wound left open and packed with iodoform gauze, the edges of the wound being drawn together at the end of twenty-four or forty-eight hours, according as the quantity of fluids exuded from the exposed surface was more or less.

This method may be used, whatever the form of the incision may be, and recommends itself especially in this particular class of cases, in that it allows of the free evacuation of fluids after the operation from a surface which it is sometimes difficult to make dry, and from which it is very difficult to remove all wound-infecting material.

It must be said, however, that so far as the results of the operations in this particular series of cases are concerned, no one of these methods of carrying them out was distinctly more favorable than another, failures and successes in securing union by first intention having occurred with each of the various modifications in nearly equal proportions.

In no instance were these operations followed by any deleterious results, and the writer feels justified in urging a more extended trial of this method of treating buboes, which are already suppurating, than is now in vogue. The one advantage of this method of treatment, when it is successful, over the more usual one of incising and curetting suppurating buboes and letting the wounds heal by granulation, is, of course, the obvious one of being able to discharge the patient entirely well at the end of ten days or a fortnight, instead of at the end of from three weeks to two months.

The average duration in the Hospital of the ten cases in which the wounds healed by first intention was sixteen days. Most of these cases could have been discharged in eight or ten days. Many of them, however, were patients who on being discharged were likely to be utterly careless, and who would return to unfavorable conditions, so they were detained as a matter of precaution. The shortest was eleven

days; the longest, twenty-eight. The average duration in the Hospital of the twelve cases in which primary union did not occur, and which healed by granulation, was thirty-four days.

It is difficult to say to what special conditions the failures or successes were due in these cases. As has been said, they were not determined by the particular manner of carrying out the operations, nor could they be referred to the actual condition of the buboes or to their nature, for some of those that seemed the most unpromising united by first intention, whilst others in which there seemed every reason to expect success failed to do so in part, although entire failure did not occur in any, and in the partial failures convalescence was uninterrupted though delayed.

The writer advises against the use of solutions of the stronger antiseptics in the wounds, and thinks it preferable to cleanse the wound cavity by thoroughly scrubbing it with iodoform gauze. Before suturing the wound, if that plan be adopted at once, it should be made as dry as possible, and finally the wounds should be dressed with large, dry, sterilized gauze dressings, pressure being applied over the area of the wound to prevent the cavity left by the dissection from filling up with fluids.

NOTE. — Since the above report was written eight more cases are to be added: four in which my colleague, Dr. H. W. Cushing, operated, and which he kindly allows me to report, and four of my own.

Dr. Cushing secured primary union in three of these four cases. One of these was of gonorrhœal, one of traumatic origin; the nature of the other two is not noted.

The average stay in the Hospital of these cases was seventeen days. In nine others which were treated by free incision and thorough curetting and the wounds left open to heal by granulation, the average stay in the Hospital was twenty-two days. All of these, however, were discharged before healing was complete, and were treated as out-patients for from one to three weeks longer.

In the last four cases of my own, primary union occurred in two.

In all there have been thirty operations, with primary union in fifteen of them.

In the interval before this report goes to the publisher I am enabled to add four more cases, the last upon which I have operated. In three of these, union by first intention was secured. In the fourth there was failure — the latter was tuberculous. The three former were respectively of gonorrhœal, syphilitic, and simple inflammatory origins.

XII.

EXTRADURAL AND SUBDURAL HEMORRHAGE.

By E. H. Bradford, M.D.

The following cases of cranial injury are reported as illustrative:

Case 1. Extradural Hemorrhage, Ligature of the Middle Meningeal Artery, Trephining, and Recovery.

I. B. D., male, sixty years of age, was thrown from his carriage against a telegraph pole, striking on his head, and was taken to the Hospital within an hour. He was semi-conscious on entrance, but was aroused partially by supra-orbital pressure; pupils were equal, contracted, but both reacted; moved all his extremities, but the right most freely. There was slight hemorrhage from the right ear; there was right conjugate deviation of both eyes, with slight nystagmus; pulse was strong and regular. There was in the right parietal region a contused scalp wound without exposure of the bone. Ten minutes later there was complete paralysis of the left arm and leg, with apparent loss of sensation; then the right pupil dilated and failed to react, with ptosis of lid and involuntary micturition. There was a spastic condition of the right arm, but no convulsions or clonus.

Patient examined by Dr. Bullard in consultation.

The patient was operated upon immediately, at 11.30 in the evening; scalp and periosteum were elevated, and a fissure of the skull extending upwards and forwards was discovered; a trephine button was removed over the course of the right middle meningeal artery, another behind, and a third slightly above the first. The opening was enlarged by means of the rongeur forceps; a large extradural clot

was evacuated, the middle meningeal artery was tied, with complete cessation of hemorrhage. The wound was packed with gauze and closed with an interrupted suture, and an antiseptic dressing applied. The operation lasted forty-five minutes.

The patient regained consciousness at 3.30 and complained of pain in the head; in the morning told his name and moved all his extremities. The right pupil became the same size as the left, but right ptosis continued. The wound was dressed the following day. The patient made a rapid and uninterrupted recovery, and was discharged from the Hospital a month later, with a small sinus. A fragment of necrosed bone was removed subsequently.

Case 2. Subdural Hemorrhage; Contusion of the Brain; Trephining; the Removal of a Large Clot; no Ligature of the Middle Meningeal; Death.

S., aged forty, was admitted to the Hospital in an unconscious condition, with the statement that he had been struck upon the head by some blunt instrument, and had become immediately unconscious, but was partially aroused by supra-orbital pressure. The right pupil was larger than the left and not reacting. There was complete paralysis of the left side, none of the right; the respiration was rapid and stertorious; pulse rapid and of fair strength. There was a scalp wound three inches long directly above the right eye extending upwards and inwards. Trephining was done immediately, a flap of periosteum removed, a large trephine being used. On removal of the button of bone, the dura bulged with slight pulsation; this was opened and a large subdural clot was found. This was irrigated out, followed by fresh hemorrhage, which finally ceased; periosteum and scalp were replaced and wound closed with interrupted suture. The next day the patient moved the fingers of the left hand, but both pupils were equal and reacted; patient was restless and unconscious; involuntary micturition. The next day the patient was partially conscious; following day died.

At autopsy, a large amount of blood clot was found overlying the whole right hemisphere; contusion of the brain

was present beneath the seat of injury, and a second area of ecchymosis at the posterior extremity of the right occipital lobe.

Case 3. Extradural Hemorrhage; Ligature of the Longitudinal Sinus; Recovery; and Subsequent Death.

Male, forty years of age, entered the Hospital in a conscious but lethargic condition, with breath smelling of alcohol. A three-cornered scalp wound was found in the right frontal region an inch and a half long which led to depressed bone. Pupils reacted, no paralysis was present. The statement was that he had been struck on the head with a beer mug. Patient walked to the station-house, and was brought to the Hospital.

Patient examined by Dr. Bullard in consultation.

Under an anæsthetic the wound was enlarged, the depressed area was exposed, and several fragments of depressed bone were raised. Parts of the anterior table were removed, and fragments of the inner table were found wedged beneath the edges of solid bone, pressing upon the dura and projecting through it. These were removed, and copious hemorrhage followed; wound was enlarged with rongeur forceps, and the longitudinal sinus was exposed; this was ligated in two places, and hemorrhage ceased. After the operation, the patient was rational and recognized friends; the following day had three epileptiform convulsions, was slightly delirious, slight rise of temperature. Five weeks later was discharged from the Hospital with wound entirely healed, patient apparently well. A month later was found dead in bed, apparently after neglect and exposure.

At autopsy, an abscess the size of a hen's egg was found in the frontal lobe; abscess entirely encysted and was being slowly absorbed.

Case 4. Extradural Hemorrhage; Ligature of the Middle Meningeal; Recovery.

Patient, man, thirty-one years of age, brought to the Hospital in a conscious condition and able to move all extremities; pupils were equal and reacted; pulse was slow and of good strength; in the left parietal region there was a lacer-

ated scalp wound just above the ear, one inch long and parallel to the axis of the skull; bone was fractured and depressed. The patient had fallen thirty-five feet, fifteen minutes before entrance, from a roof of a building. Paralysis of the right arm and gradual loss of consciousness was noticed shortly afterwards; nystagmus of both eyes developed, chiefly lateral, beginning with an upward movement; pupils alike and reacting; total paralysis of the right arm soon developed; knee jerks were absent; muscular action was better on the right than on the left lower extremities; reacted to sensory impressions on soles of feet; pulse was 55.

Patient examined by Dr. Bullard in consultation.

Three hours after injury the wound was enlarged, periosteum elevated, and an extradural clot revealed. Two trephine buttons were removed and the corners trimmed off by means of rongeur forceps; a large clot was removed showing arterial hemorrhage; posterior branch of the middle meningeal artery being tied by means of a curved needle and suture the hemorrhage was controlled; the dura was not perforated; wound was closed with interrupted suture except in the centre, which was left open for drainage. Patient showed signs of collapse at the end of operation and stimulants were administered, but reacted quickly. Patient recovered consciousness rapidly, a week later was allowed to sit up in bed, and two weeks later was discharged to his home with the wound entirely healed.

Case 1 is illustrative of the feasibility of diagnosis, and of the value of treatment. The paralysis developed gradually after a lucid interval and became profound, being at first more marked on one side than the other.

Recovery began as soon as the pressure was removed from the brain and hemorrhage stopped.

In case 2 death resulted either from the contusion of the brain or from the failure to secure the bleeding point.

The death in case 3 can hardly be attributable to the operation as it occurred after a complete recovery from the operation. Abscess may have been from sepsis, or it may have been due to the interference of the blood supply. The man after leaving the Hospital was a victim of exposure and was found dead in a hovel.

In case 4 the symptoms were clearly marked, and the efficacy of treatment was as noticeable as in case 1.

SYMPTOMS.

Hemorrhage within the cranial cavity without laceration of the brain substance is not uncommon. Dwight found in the 169 autopsies for injuries of the head occurring at the City Hospital (mentioned in another article of this report), 62 deaths from compression from hemorrhage without other cerebral injury of sufficient extent to complicate the case. Of these, in 49 the hemorrhage came from the middle meningeal artery.

Nichols mentions in a paper published in this report 32 cases of head injury, 11 with extradural hemorrhage, and 2 with localized subdural hemorrhage.

According to Dwight, in nearly every case where a fracture extended from the vault into the middle fossa, the middle meningeal was injured and hemorrhage followed the injury. Fracture of the vault and middle fossa alone, with compression from hemorrhage, was found in 26 cases; in 4 cases this was complicated with sepsis, without other injury. There were 19 cases of fracture of the vault through the middle fossa, with compression.

It will therefore be seen that in a large proportion of the fractures of the skull, without laceration of the brain substance, extradural hemorrhage exists. An absence of injury to the brain substance can be inferred if it is evident that there has been a period of complete consciousness following the accident; but a diagnosis between extradural hemorrhage and subdural hemorrhage is difficult if not impossible. Inequality in the size and loss of reaction of the pupil is characteristic, and was noted in two of the cases here reported. Dilatation of the pupil on the side of the pressure is also frequently seen as a later symptom, and is to be explained on the theory that the extravasated blood gradually descends and causes direct pressure upon the nerve regulating the contraction of the pupil. This symptom was noted in two of the cases here reported.

It would at first be supposed that the resistance of the

compressed brain substance, as well as the attachments of the dura mater, would be sufficient to check the hemorrhage proceeding from an artery no larger than a branch of the middle meningeal, but experience has proved that this is not the case.

In the first case here reported an extradural clot was found of a thickness of two inches from the parietal bone and six inches in its longest diameter. The brain is compressed so as to form a concavity at its external surface; the dura is stripped from its attachment to the skull, and coma, unconsciousness, and death may result from the compression of the brain. Nancrede claims that if one-twelfth of the capacity of the cranium is occupied by a clot, coma and death will follow in a few hours. The clots in the cases 1, 2, and 4, here reported, could be estimated as larger than this.

The symptoms necessarily vary, but in cases not accompanied by injury of the brain substance, the characteristic history is that of a period of consciousness after the accident, followed by a period of stupidity gradually increasing to unconsciousness after a varying interval. This was well illustrated in the fourth of the cases here mentioned, the patient giving a clear account of the accident, and not prevented from walking on entrance into the Hospital. This condition was followed by unconsciousness and partial paralysis after a few hours.

The pressure symptoms which especially attract attention are paralysis and muscular rigidity; the paralysis is partial unless important motor centres are compressed, when complete paralysis follows. Frequently the paralysis is limited to the motor centres of the arms or legs; from the nature of the case, however, and the situation and extent of the extravasation, these symptoms vary greatly.

Jacobson mentions the following seven conditions, which are to be observed in middle meningeal hemorrhage: First, hemiplegia well marked in the leg and arm with complete paralysis so that the arms drop when raised. This condition, he claims, exists in one-third of the cases. Second, slight hemiplegia. Third, only a temporary hemiplegia due to the ability of the brain to accommodate itself to the pressure.

Fourth, a paralysis more marked in one limb than in another. Fifth, a general paralysis. Sixth, the absence of any paralysis. This latter is very exceptional, however. Seventh, rigidity or twitching of the limbs. This latter, however, indicates the probability of the existence of some injury to the brain substance.

Hutchinson and others have pointed out the importance of the variation in the size of the pupils. If the pupils react naturally, the symptom is favorable, if trephining is immediately performed. If the pupils do not react, the prognosis is not as favorable. One pupil may be found dilated and the other contracted. This, with other symptoms, indicates the presence of a large clot. If compression has become well marked, the pulse will be found more slow than is normal.

Unconsciousness is observed as the hemorrhage becomes extensive. The presence of localized paralysis alone, without other compression symptoms, is not, of course, positively indicative of hemorrhagic compression; but if this is followed by increasing pressure symptoms which may mask eventually the localized paralysis, the diagnosis becomes a probable one, if the pressure symptoms appear soon enough after the injury to justify the exclusion of compression by an increasing suppuration.

The presence or absence of vomiting is itself of little significance; the persistence of vomiting would be naturally an unfavorable symptom, as well as the failure of the pupil to react, as has been shown by Lovett and Monro, City Hospital Reports, and by Nichols in an article in the present report.

The presence of an increasing intercranial pressure shortly after an injury, with at first an interval of freedom from symptoms, is characteristic of extradural hemorrhage; if the resulting paresis or paralysis becomes more marked on one side than the other, the diagnosis becomes one of reasonable certainty.

If, after a head injury, consciousness which was lost immediately, returns, the case may be considered one of concussion. If, then, after a short lucid interval, unconsciousness comes again, a hemorrhage may be considered as having taken place, and has reached a point at which it exerts

compression. If, after an injury, consciousness does not return and paralysis persists, the brain is compressed by depressed fragments or is injured; but should consciousness finally return and the paralysis disappear, then the brain has either accommodated itself to the pressure, or the hemorrhage has been re-absorbed. If the clot is a large one, according to Bergman, absorption does not take place. — *Deutsche Chirurgie*, vol. xxx., xxxi., p. 369.

Ransohoff found in his collection of cases that the lucid interval varied from a few minutes to two days; in one in twenty cases it was more than two days. In the case reported by him the interval was a week. Paralysis was absent in only sixteen of two hundred fifty-seven cases according to Weisman, or two in seventy according to Jacobson. Secondary hemorrhage was reported in four cases.

The length of the period of the lucid interval depends upon the rapidity of the hemorrhage and the extent of the rupture, and also upon the size of the ruptured vessel.

Hemorrhage from rupture of the middle meningeal is much more common than from any other cause.

Stewart found, in thirty-one cases, the middle meningeal the ruptured vessel in twenty-seven, the sinuses the next most common, and the posterior meningeal the most rare.

TREATMENT.

If it is borne in mind that the skull is an unyielding box, it is evident in cases with compression from hemorrhage that opening the skull and removing the clot seems the proper treatment.

Where trephining is done in time in cases where no laceration or contusion of the brain substance is present, there is a probability that a larger number of recoveries would follow in fractures of the skull than at present is the case. This would appear to be supported by statistics.

Bergmann has collected 99 cases of cerebral hemorrhage, of which only 3 were trephined.

The 3 trephined recovered; 83 died, not trephined; 13 recovered, not trephined.

Weissmann ("Deutsche Zeitschrift f. Chir.," vol. xxi., pp. 1 to 79, 283 to 334; vol. xxii., pp. 52–149) has col-

lected 257 cases of head injury, a majority being with hemorrhage.

One hundred and forty-seven received expectant treatment, no operation: 16 recovered, 131 died.

One hundred and ten were trephined: 74 were cured, 36 died.

Duchaine ("Ruptures de l'Artère Meningée Moyenne," Paris, 1890) found in 27 cases which trephined, 21 recoveries, 6 deaths; 7 cases not trephined: 1 recovery, 6 deaths.

The following cases of trephining for cerebral pressure from hemorrhage in the recent literature have been collected by Dr. J. B. Blake:

Case 1. Reported by Ghent. "Gaillard's Medical Journal," New York, August, 1891. Symptoms of compression. Extradural clot found. Recovery.

2. Carson. "Medical Mirror," St. Louis, August, 1891. Compression. Subdural clot. Recovery.

3. Michaud. "Semaine Medical Journal," April 1, 1891. Symptoms of compression. Subdural clot. Recovery. The hemorrhage in this case was nontraumatic.

4. Guldemeux. "British Medical Journal," August 22, 1891. Compression. Extradural clot. Recovery.

5 and 6. Lamphear. "American Journal of Surgery and Gynecology," June, 1892. Symptoms of compression. Extradural clots. Recovery.

7. Starr and McBurney. "Brain," London, parts 2 and 3, page 91. Clot under pia. Symptoms of middle meningeal hemorrhage. Recovery.

8. Maglioni. "Revue de Médecine," December, 1891. Compression. Extradural clot. Trephining done late. Death.

9. Ruth. "Journal of American Medical Association," February 6, 1891. Compression symptoms. Extradural clot. Recovery.

10. Stewart. "Edinburgh Medical Journal," February, 1892. Extradural clot. Recovery.

11. Smart. "British Medical Journal," December 5, 1891. Basal clot. Recovery. The source of the hemorrhage in this case was not found, but there were symptoms of middle meningeal hemorrhage.

12. Puzey. "Liverpool Medico-Chirurgical," July, 1892. Symptoms of concussion. Extradural clot found. Recovery. Compound fracture. Both ends of the torn meningeal tied.

13. Dercum. "Medical News," March 30, 1889. Symptoms of compression. Extradural clot. Death. Patient recovered well, but on the sixth day after operation stole brandy and became intoxicated.

14. Stimson. "New York Medical Journal," December 5, 1891. Subdural clot. Recovery slow, and not yet complete.

15. Davies-Collie. "Lancet," March 31, 1888. Symptoms of compression. Extradural clot. Recovery. Case trephined on the eleventh day.

16. Croft. "Lancet," January 19, 1889. Symptoms of compression. Subdural hemorrhage. Recovery.

17. Stoker. "British Medical and Surgical Journal," April 9, 1888. Extradural clot. Recovery.

18 and 19. Walker. "Medical and Surgical Reporter," June 9, 1888. Extradural and subdural (compound fracture). Recovery in both.

20. Areilza. "Provincial Medical Journal," March 1, 1888. Compression symptoms. Extradural clot. Recovery.

21 and 22. McEwen. "Lancet," January 11, 1888. Probable subdural clot. Recovery in both.

23. Allingham. "British Medical Journal," April 20, 1889. Symptoms of compression. Subdural clot. Recovery.

24. Bellamy. "Lancet," June 15, 1889. Extradural. Compression symptoms. Death. Bleeding points found and tied. Multiple basal fractures found at autopsy.

25. Holger Mygind. No reference. Summary in "Sajou's Annual for Medical Science," 1889, Vol. iii, A 14. Extradural clot. Death. Compression symptoms. Patient died during the operation, before clot was evacuated. Autopsy confirmed the diagnosis.

26. Owen. "British Medical Journal," October 13, 1888. Compression symptoms. Subdural clot. Recovery.

27. Harrison. "Liverpool Medico-Chirurgical," July,

1888. Compression. Extradural. Recovery. After removing clot fresh bleeding occurred; source undiscoverable. Three hours of pressure on common carotid and the patient recovered.

28. Harrison. Compression symptoms. Extradural hemorrhage. Fresh hemorrhage after removal of clot, arrested by actual cautery.

29. Brunner. "Munich Medical Wochenschrift," July 28, 1888. No symptoms of compression. Extradural clot. Compound fracture. Middle meningeal tied. Recovery.

30. Landerberger. "Northwestern Lancet," January 15, 1888. Compression. Extradural clot. Recovery. Pus with blood beneath the skull. Fracture of both legs with gangrene, and amputation of one.

31, 32, and 33. Brunner. "Correspondenz Blatt für Schweitze Aertze," June 15, 1888. First: Extradural clot. Recovery. No unconsciousness. Compound fracture. Middle meningeal tamponed with iodoform gauze. Second: Compression. Extradural clot. Recovery. Compound fracture. Middle meningeal tied with catgut. Third: Compression. Extradural clot. Death. Improved steadily for two days, then acute pneumonia.

34. Ransohoff. "Transactions of American Medical Association," 1890, page 167. Symptoms of compression. Extradural clot. Death. Not operated upon until the eleventh day. Patient able to go about for a week after accident. Secondary hemorrhage from middle meningeal two days after operation. Common carotid tied. Pyæmia from carotid at point of ligature.

35 and 36. Eliot. "Boston Medical and Surgical Journal," February 9, 1893. Recovery.

37. Weist. "Transactions of American Medical Association," 1890, page 167. Recovery.

38. Homans and Walton. "Boston Medical and Surgical Journal," February 12, 1891. Subdural clot from contrecoup. Recovery.

If to these cases the four cases here reported are added, a list of forty-two cases is given, with eight deaths. Of the fatal cases, one died of acute pneumonia, a second during the operation before the clot was evacuated, a third after a

debauch, a fourth with multiple basal fracture, a fifth a month after recovery, after exposure, and a sixth where contusion of the brain was found at autopsy.

With forty-two cases, and eight deaths, the mortality of the operation cannot be regarded as high, — twenty per cent., — considering that it is reasonable to suppose that a greater number of these cases were doomed unless operated upon.

The conclusions which have been formulated by Duchaine well express the present surgical views on the subject.

Ruptures of the middle meningeal are the most common complication of fractures of the skull in the fronto-parietal region.

In simple cases the symptoms develop themselves uniformly.

It is possible and sometimes easy to diagnosticate the rupture of a middle meningeal artery.

If the affection is abandoned to itself, death is the most frequent result.

Trephining, when done early, usually gives a favorable result.

EXPLORATORY TREPHINING.

However skilful a diagnostician experience may make of a surgeon, in a large number of cases a precise diagnosis will be impossible from the inherent difficulty of the question and for the reason that accurate data cannot always be obtained. It is certainly desirable that a surgeon should possess reliable means of ascertaining the presence and localization of extra-cerebral clot. If a small opening can be made in the skull with rapidity, with but little loss of substance of bone, in certain instances of doubt, in grave emergencies this undertaking would be justifiable.

Trephining through the thickest portions of the skull may be a tedious process, requiring considerable time and prolonging the danger of the shock. If two or more trephine holes are required, as is sometimes the case, the patient is exposed to a prolonged operation.

Bergman mentions the difficulty of diagnosticating extradural from subdural clots, and quotes the case of Parker in the "Medical Times and Gazette" of 1877, vol. i., page 91,

where a diagnosis of right side middle meningeal hemorrhage was made, but nothing was found on trephining. The trephine was then applied to the left side without discovery of any hemorrhage. The dura was then opened and a large clot was discovered. The patient was cured.

The use of the chisel in opening the skull has been agitated by many, and it has great advantages; but in cases of fracture it has the disadvantage of increasing the amount of damage to the skull, and there is always the danger.

The chisel presents certain advantages over the trephine, and is advocated by some surgeons.

Volkmann — "Berlin Klinische Wochenschrift," December 16, 1889 — advocates the use of the chisel, and claims that the trephine tears the bone, causes sawdust, coagulates the blood, causes necrosis, and wounds the dura and brain.

Küster claims that the chisel causes greater violence and shock than the trephine.

Salzer is opposed to the chisel, — "Weiner Klinische Wochenschrift," December 5, 1889.

Keetley, in the "Medical Press and Surgery," London, December 31, 1890, claims that the trephine is only to be used in making large holes, and concussion from blows with the chisel is only objectionable if arteries are atheromatous.

Gerster — "New York Medical Journal," February 21, 1891 — claims that the trephine is inadequate and dangerous to the dura; the chisel is better.

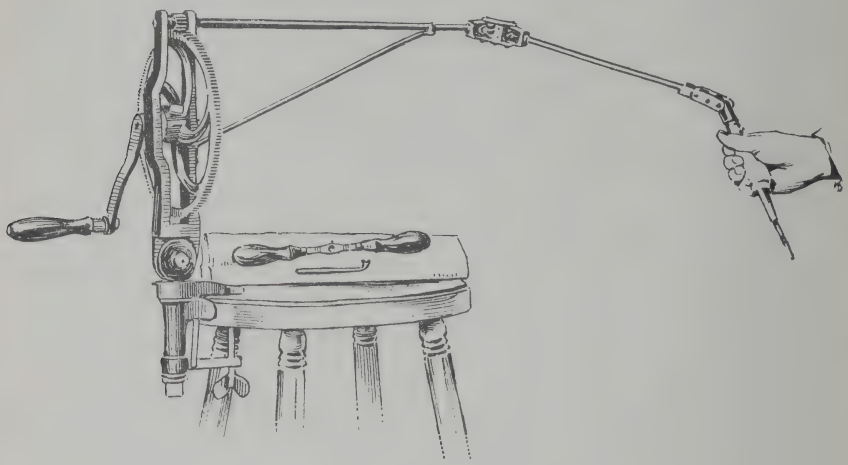
But the chisel can never safely be made an instrument for rapidly opening the skull, as is needed in exploratory trephining.

It is difficult to avoid some concussion of the brain unless the chisel is used with great care, and in fractures of the skull the chisel hardly recommends itself.

The various so-called "dental engines" which have been used in bone operations have been furnished with a spiral-spring arm. This has the disadvantage of causing too great vibration if much power is applied, and they therefore lack delicacy, and in many instances sufficient power is not afforded for trephining.

The instrument which is depicted in the accompanying illustrations is found to possess some advantages. It was

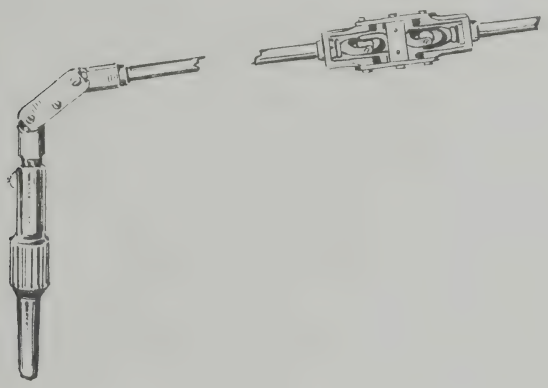
manufactured at my suggestion by Messrs. Codman & Shurtleff, Boston. The power is manual power, though it is possible at any time to attach the arm to an electric motor. In practice I have preferred the arrangement described here, for the reason that it is portable and the speed can be very



readily regulated. It will be found to furnish all the speed and power that is desired and without sacrificing the necessary delicacy. It will be seen that this instrument consists of a long arm broken at two points by a double universal joint. At the second joint the handle to hold the necessary trephine or cutting instrument is attached. The first joint enables the arm to be moved in every direction beyond a right angle; this, combined with the second, gives an arc of motion of nearly 180 degrees. The arm is inserted into the centre of a small wheel furnished with gearing and driven by a larger geared wheel, both fixed upon a stand which can rotate in a circle, and which can be screwed upon any table or chair; by an adjustment checked by a screw and spring, the instrument can be inclined at any desired angle.

These attachments enable the surgeon to move the point of his instrument to all necessary parts required in trephining. The trephine or instrument needed for perforating the skull is inserted into the grip or handle, and an assistant turns the handle which moves the geared wheels. With this power it will be found that a skull can be rapidly perforated

either by means of a small trephine one-quarter of an inch or one-half an inch in diameter, as may be necessary. A circular saw can be attached to this instrument and a triangular piece removed from the skull if necessary, cutting from one trephine hole to another, or a larger trephine can be used. It need hardly be added that instruments can be used with a burr point for smoothing off roughened bone, and that an attachment can be made regulating the depth with which the trephine can be allowed to enter. As the small trephine used is too small for a centre pin, it is necessary to



furnish some means by which slipping at the first application of the trephine is to be prevented. This is done in the following way: A short flat bar of steel is made with a handle at each end; a hole is cut in the middle, of a size corresponding to that of the small trephine; the assistant places this firmly upon the skull; the end of the trephine is inserted in the hole in the strip of steel, and after it is well in place the assistant turns the handle of the trephine. After a groove has been cut the steel can be removed and the trephine again applied into the cut groove.

Delicacy can be secured by regulating the speed with which the trephine is driven, a slow alternating forward-and-back motion being possible, as in a hand trephine.

To make the instrument more delicate, if this is desired, the last few strokes of the trephine can be made by the surgeon's hand alone, — as in the ordinary hand trephine, — if a

small hand-attachment be applied to the shaft of the trephine and the driving-wheel handle be not turned by the assistant.

At first this seemed necessary; but subsequent experience appeared to indicate that it is a precaution rather than a necessary addition.

To test the rapidity a trephine button was cut in the base of prepared dry skull in thirty seconds. To test the delicacy, a piece of paper has been pasted on the inner side of the skull and a trephine button removed from the outer side without disturbing the paper, requiring, however, more time.

The trephine has been used in a number of instances of operative trephining, and its efficacy has been satisfactorily demonstrated.

In conclusion, it is urged that extradural hemorrhage is so common a complication in fractures that it demands consideration in all instances. If symptoms indicating pressure are present where there is reason to believe that the brain substance is not lacerated, the trephine should be used. By rapid exploratory trephining the slight risk from operative interference is more than compensated for by the certainty of diagnosis and the chance of relief and probability of cure.

XIII.

A STUDY OF ONE HUNDRED AND SIXTY-NINE AUTOPSIES IN WHICH FRACTURES OF THE SKULL WERE FOUND.

By Edwin W. Dwight, M.D.

The cases included in the following study consist of one hundred and sixty-nine consecutive autopsies made at the Boston City Hospital, in which either a fracture of the skull or a separation of one or more sutures was found. A large number, more than a hundred of these cases, occurred in the practice of Dr. F. W. Draper as medical examiner, and it is through his kindness that I am enabled to report so large a number.

The number of each variety of fracture, as they are here reported, might give a wrong idea of their comparative frequency, if it is not considered that nearly, if not quite, all of these autopsies were done in order that the cause of death might be ascertained. In that very large class of cases where, after very severe accidents from one cause or another, bad compound depressed fractures, gun-shot wounds, or crushes of the skull are found, and the diagnosis and cause of death are readily to be made out, no autopsy was done, and therefore they do not appear in this paper.

This will explain the very small number of depressed fractures, gun-shot wounds, and railroad accidents, as well as the small number of deaths in less than twelve hours, and where death was due to multiple injuries.

It will be noticed that in many of the cases accurate data could not be obtained, and where the number given does not equal the total number reported, it will be understood that in the other cases the facts, for one reason or another, were wanting.

Included in the one hundred and sixty-nine cases were found twenty cases of gun-shot wounds and three of separations of sutures without fractures, leaving one hundred and forty-six cases of true fracture of the skull to be considered in their various relations. We find the fractures divided, as to their positions and extent, as follows:

Fissure of vault alone						6	cases.
"	"	extending into anterior fossa				7	"
"	"	"	"	middle	"	50	"
"	"	"	"	posterior	"	13	"
"	"	"	"	anterior and middle fossæ		20	"
"	"	"	"	middle and posterior fossæ		15	"
"	"	"	"	anterior, middle, and posterior fossæ		7	"
Depressed fracture of vault localized						9	"
"	"	"	extending into one fossa,			7	"
"	"	"	extending into two or more fossæ			9	"
Fissure of base (not extending to vault)						3	"
						146	cases.

It is of considerable interest to note the very large proportion in which the base was involved, viz., one hundred and thirty-one, or $89\frac{2}{3}\%$; of these all but three were extensions from fractures of the vault. Of the whole number (131) involving the base, seventy-eight were limited to a single fossa (as follows: anterior fossa, 10; middle fossa, 54; and posterior fossa, 14); forty-two involving two fossæ, and eleven in which all three fossæ were affected. The anterior fossa was involved in forty-three cases, the middle in one hundred and seven, and the posterior in forty-one.

All of the cases of fissure limited to the vault occurred in persons under the age of forty; two were under ten years; one between twenty and thirty; and two between thirty and forty. The character of the injury has apparently little to do with the fractures of this class. One was due to direct vio-

lence, two were struck by trains, and one fell twenty feet. In none was the diagnosis made before death. Two were considered fractures of the base of the skull, two alcoholism, and one was supposed to be simple concussion without fracture. External hemorrhage was present in two cases: in one from the nose, and one from both ears and the nose; and in three there was no hemorrhage. Death occurred in five of these cases in twelve to twenty-four hours, and one lived two days. The cause of death was in one case concussion; one, laceration; and two, compression of the brain; one died of multiple injuries, and one of intercurrent disease. The internal hemorrhage was in two cases on the surface, in two on the surface and into the brain substance, and in one into the lateral ventricles. Only one of these cases would have been considered operable; in that the hemorrhage was entirely superficial, and the patient died in twenty-four hours, of compression. The diagnosis, however, was not made, the patient being considered drunk and no physician called.

There were seven cases where the fissure of the vault extended into the anterior fossa alone; in these the age has apparently no bearing. One was between twenty and thirty years old, one between thirty and forty, one between fifty and sixty, and one was over sixty; one was due to direct violence, and one thrown from a moving horse-car.

In two cases there was no external hemorrhage, in one bleeding from the nose, and in two subconjunctival ecchymosis. The diagnosis was made in three cases of "Fracture of the Base;" no location given; in two of cerebral compression; and one was considered alcoholism. Two died within a few moments, one in from six to twelve hours, two in twelve to twenty-four hours, and two lived from one to there days.

The internal hemorrhage was in three cases on the surface, one on the surface and into the brain substance, and one into the lateral ventricles.

The cause of death in four was cerebral compression; in one, laceration of the brain; and in two, compression and laceration.

Three of these cases might be considered operable; in these the hemorrhage was entirely superficial and in the

anterior fossa, and the patients died in from eighteen to forty-eight hours, of cerebral compression.

There were fifty cases where the fissure of the vault extended into the middle fossa alone; of these, one was less than ten years old, twenty-six between twenty and forty, seven from forty to fifty, one from fifty to sixty, and four were over sixty years.

Five resulted from falls on the street, eight fell downstairs, twelve were due to direct violence, two were struck by trains, three fell between ten and thirty feet, and eleven were unknown, most of them being picked up on the street, and probably either due to assault or falls.

In sixteen cases there was no external hemorrhage, in two from the nose alone, one from both ears, and one from ears and nose; in six cases there was bleeding from one ear and the nose, and in eight from the mouth, nose, and one ear.

Subconjunctival ecchymosis was present in six cases.

The diagnosis of "Fracture of the Base" was made in twenty cases, in one fracture of the vault alone; four were considered as cerebral compression, no fracture being made out; five were supposed to be merely scalp-wounds, three concussion, five alcohol, three general contusion; and two were admitted to the medical side of the hospital as "Cerebral Hemorrhage," there being no history or sign of injury.

The elapsed time to death was in six cases less than six hours; in twelve, from six to twenty-four hours; in ten, from one to three days; eight, three to seven days; two, seven to fourteen days; and two lived over fourteen days.

The cause of death was as follows: Twenty-six from cerebral compression, three from laceration of the brain, and ten from combined compression and laceration; two died of shock, four of sepsis, three from multiple injuries, and two of intercurrent disease.

The internal hemorrhage in thirty-five cases was entirely upon the surface, and in eight on the surface and into the substance of the brain. All of the twenty-six cases dying of compression, excepting two, were operable, the fracture starting in the parietal bone and running downward and forward, either in or across the middle meningeal groove,

the patients dying from meningeal hemorrhage and cerebral compression in from twelve hours to seven days. In the two which were not considered operable, the point of hemorrhage was not made out, there being no involvement of the meningeal arteries.

There were thirteen cases of fracture of the vault extending into the posterior fossa; of these, three were between twenty and thirty years, three from thirty to forty, two from forty to fifty, and one was over sixty. The injury resulted in one from a fall on the street, in four from falls downstairs, one from direct violence, and one was struck by a team; two fell less than thirty feet, and three were from unknown causes.

External hemorrhage was not present in two cases, there was bleeding from the nose in one, from both ears in one, from both ears and nose in one, from mouth, nose, and one ear in one, and subconjunctival ecchymosis in two cases. The diagnosis of fracture of the base was made in one case, cerebral compression in two, cerebral concussion in three, alcoholism in two cases, and one was admitted to the medical side as cerebral hemorrhage.

One died in ten hours, four in twelve to twenty-four hours, five in from one to three days, and two lived from three to seven days. One died from concussion, four from compression, and two from laceration of the brain, with four from laceration and compression combined; one died of shock, and one of intercurrent disease.

The internal hemorrhage was in four limited to the surface, in four on the surface and into the substance, and in one case into the lateral ventricles. In the three cases where the hemorrhage was limited to the surface, and the patients died from cerebral compression, the hemorrhage was in one from the meningeal, the fissure beginning well forward in the parietal bone, in the other two from the lateral sinus.

Twenty cases were found where the fissure of the vault extended into both the anterior and middle fossæ; of these, three were under twenty years old, one between twenty and thirty, five from thirty to forty, six from forty to fifty, and three were over fifty years. The injury occurred in two from falls on the street, four from falls downstairs, five by direct

violence, and four were thrown from moving cars; the injury in five cases was unknown.

In seven there was no external hemorrhage; in four there was bleeding from the nose, in three from both ears and nose, in two from one ear and nose, in one from mouth and nose, and in two from mouth, nose, and both ears. The diagnosis of fracture of the base was made in five cases, of cerebral compression in two, and of concussion in one. Two were supposed to be simply scalp-wounds, while alcohol, epilepsy, and general contusions had one each.

One died in less than six hours, three in from six to twelve, and two from twelve to twenty-four; six lived from one to three days, five from three to seven, while one lived for ten days, and one for eighteen. The cause of death was in one case concussion, in six compression, three laceration of the brain, and six combined laceration and compression; there was one death from sepsis. The internal hemorrhage was in eight cases limited to the surface, in eight both on the surface and into the substance, one was into the brain substance, and two into the lateral ventricles. Of this class six may be considered as operable; the origin of the fracture was in each case in the parietal bone, and the hemorrhage was meningeal and limited to the surface; five of these cases died of compression, and one of sepsis.

Of fissures of the vault extending into the middle and posterior fossæ there were fifteen cases. Of these, eight were between twenty and forty, two from forty to fifty, three from fifty to sixty, and two over sixty. One was run over by a wagon, two fell on the street, one fell more than thirty feet, two fell downstairs, two were struck by teams, two fell less than thirty feet, two were the result of direct violence, and the injury to three was unknown.

In five cases there was no external hemorrhage, in two there was bleeding from both ears, one from both ears and nose, three from one ear and the nose, and four from one ear, the nose and mouth; there was subconjunctival ecchymosis in four cases. The diagnosis of "Fracture of the Base" was made in eight cases, of fracture of the vault alone in one, and one each of shock, scalp-wound, alcohol,

general contusion, and cerebral compression; one case was admitted to the medical side as "Cerebral Hemorrhage."

The elapsed time of death was in two cases less than six hours, in one six to twelve, in four from twelve to twenty-four, one two days. Two were three to seven days, two were seven to fourteen days, and one lived for fifteen days. The cause of death was in five cases cerebral compression, two laceration, and three laceration and compression combined. The internal hemorrhage was in ten cases limited to the surface, and in two was into the substance.

Of the five cases that died of compression, two were from the middle meningeal, and three from the sinuses. All these cases were operable if the hemorrhage could have been localized.

Seven cases were found in which the fissure of the vault had extended into all three fossæ; of these, one was under ten years, two were between thirty and forty, and one between forty and fifty. One fell less than thirty feet, one fell downstairs, one was struck by a train, and two were the result of direct violence. In two cases there was no external hemorrhage, in one there was bleeding from the nose, one from both ears and nose, two from one ear and nose, one from ear, nose, and mouth; subconjunctival ecchymosis was present in two cases. One died in eight hours, three in twelve to twenty-four hours, one in one to three days, and one lived five days. The internal hemorrhage was in two cases on the surface, in one on the surface and into the brain substance. The cause of death was in two cerebral compression, two compression and laceration, and in one multiple injuries. Only one of these cases could be considered operable. The fissure followed the meningeal groove, and death from cerebral compression followed in forty-eight hours.

There were nine cases of localized depressed fracture of the vault; of these, one was between ten and twenty years old, four between twenty and thirty, two between thirty and forty, two from forty to fifty. One was a fall of over thirty feet, seven from direct violence; one was unknown.

In eight there was no external hemorrhage, and in one only subconjunctival ecchymosis. In eight the proper diag-

nosis of localized depressed fracture was made, and one was considered as alcoholism. The internal hemorrhage was in seven cases on the surface, and in two into the brain substance. The cause of death was in two cerebral compression, one compression and laceration, one intercurrent disease, and in five sepsis. Eight of these cases were distinctly operable.

There were seven cases of depressed fracture with fissure into a single fossa; of these, two were between twenty and thirty, one forty to fifty, one fifty to sixty, one over sixty. One was the result of a fall downstairs, one fell more than thirty feet, one was struck by a train, and two were from direct violence.

There was bleeding from one ear and nose in one case, and subconjunctival ecchymosis in one. The diagnosis of fracture of the base was made in three cases, and of localized depressed fracture in two. One died in less than six hours, two in from six to twelve, one from twelve to twenty-four, and one lived six days. The internal hemorrhage was in three cases upon the surface, and in two on the surface and into the substance as well. Death resulted in two cases from compression and laceration of the brain, in one from sepsis, and one from multiple injuries. Operative interference could have helped but one of these cases, who died of sepsis after six days.

Of depressed fracture of the vault with fissures into two or more fossæ there were nine cases; of these, one was between ten and twenty years old, two were twenty to thirty, one thirty to forty, and one fifty to sixty. One was the result of a fall downstairs, one of direct violence; one fell less than thirty feet, and two were struck by trains.

In three there was no external hemorrhage, one had bleeding from the mouth, nose, and ear, and one had subconjunctival ecchymosis. The diagnosis of depressed fracture was made in four cases, fracture of the base in two, one compression, and one concussion; one was admitted to the medical wards as cerebral hemorrhage. One lived less than six hours, one six to twelve, three twelve to twenty-four, two three to seven days, and two more than twenty-one days.

Internal hemorrhage was in one case on the surface alone,

and in five into the substance as well. The cause of death in six cases was compression, one compression and laceration, and one sepsis. Three of the cases might be considered operable; in one the hemorrhage was superficial, and in the other two there was not enough laceration to preclude the possibility of recovery. Of these one died in twenty-four hours, and one in three days, of compression; the third in eighteen days, of sepsis.

There were three cases of fissure of the base without involvement of the vault; of these, one was between twenty and thirty years, and two unknown.

One was the result of a fall downstairs, and one fell more than thirty feet. The diagnosis of fracture of the base was made in one case. One of these cases lived for five days. The cause of death was in one laceration, in one laceration and compression, and one sepsis. The internal hemorrhage was in one case limited to the surface, in one to the substance, and one to the lateral ventricles.

It will be of interest to notice somewhat more in detail the relations between the various clinical facts and the character of the fractures.

Of the forty-three cases in which the anterior fossa was involved, twenty, or $46\frac{1}{2}$ per cent., had bleeding from the nose; four, or $9\frac{1}{3}$ per cent., bleeding from the mouth; and four, or $9\frac{1}{3}$ per cent., showed subconjunctival ecchymosis; while in the one hundred and three cases in which there was no fracture into the anterior fossa there was nasal hemorrhage in twenty-nine, or $27\frac{1}{5}$ per cent., bleeding from the mouth in sixteen, or $15\frac{1}{2}$ per cent., and subconjunctival ecchymosis in fourteen, or $13\frac{1}{2}$ per cent. In eighteen cases, nearly 42 per cent., where there was a fracture of the anterior fossa, there was no external hemorrhage.

In the one hundred and seven cases in which there was a fracture of the middle fossa, there was bleeding from one or both ears in forty, or $37\frac{2}{5}$ per cent.; while in the thirty-nine cases in which the middle fossa was not involved, four, or $10\frac{1}{4}$ per cent., had such bleeding. In thirty-three, or $30\frac{9}{10}$ per cent., of the cases where a fracture of the middle fossa was found, there was no external hemorrhage.

The age of the patient was noted in one hundred and

thirteen cases; of these, nine were under twenty years, sixty were between twenty and forty, eight between fifty and sixty, and eleven were over sixty years. Of the nine who were less than twenty years old, three had localized fracture of the vault; in one the fracture extended into a single fossa, and in five into two or more fossæ.

In the sixty-four cases where the age was between twenty and forty, nine were localized in the vault; one was a fracture of the base limited to a single fossa; in thirty-five the fracture of the vault extended into a single fossa, and in nineteen into two or more fossæ.

Between forty and fifty, there were two localized of the vault, ten where the fracture extended into a single fossa, and nine into two or more fossæ.

Between fifty and sixty, there were eight cases; of these, none were localized, three extended into a single fossa, and four into two or more.

Dividing the cases into three classes, — under thirty years, from thirty to fifty, and over fifty, — it is found that of the forty whose age was under thirty, eight, or 20 per cent., were localized fracture of the vault, twenty, or 50 per cent., extended only to one fossa, and twelve, or 30 per cent., involved two or more fossæ.

Between the ages of thirty and fifty, six, or $11\frac{1}{10}$ per cent., were limited to the vault, twenty-six, or $48\frac{1}{10}$ per cent., extended into a single fossa, and twenty-two, or $38\frac{7}{10}$ per cent., involved two or more fossæ. In the cases where the age was over fifty, there were no localized fractures of the vault, a single fossa was involved in ten, or $52\frac{6}{10}$ per cent., while the fracture extended into two or more fossæ in nine, or $47\frac{3}{10}$ per cent.

It will be noted that about 50 per cent. of all the cases in each class involved the vault and a single fossa, while the percentage of localized fracture of the vault decreases from 20 per cent. in those under thirty to zero in those over fifty, and that of fracture involving the vault and two or more fossæ increases from 30 per cent. in those below thirty to $47\frac{3}{10}$ per cent. in those over fifty.

The character of the internal hemorrhage was noted in one hundred and forty-three cases:

Over both hemispheres	23
One hemisphere	79
On the surface and into the substance as well	24
Into the substance alone	10
Into the ventricles alone	7
Into the ventricles as well as elsewhere	6
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The clinical condition when the cases first came under observation was as follows: Of the twenty-three cases in which the hemorrhage covered in whole or in part both hemispheres, twelve were unconscious but could be roused to a greater or less extent, one was profoundly comatose, in one progressive coma was marked, three were unconscious but restless, and two were perfectly conscious. Seventy-nine cases where the hemorrhage was limited to the surface of one hemisphere; of these, forty-one were unconscious but could be partially roused, three of profound coma, progressive coma in seven, five were unconscious but restless, and twenty were conscious — of these, four were notably stupid and eight were excited.

When the hemorrhage was in the brain substance alone, three were unconscious, three unconscious and restless, progressive coma was marked in two, and two were perfectly conscious. Where the ventricles alone were involved, three were unconscious, in one progressive coma was marked, and one was conscious but stupid.

The question of paralysis was raised in sixty cases; of these, forty had none, in seventeen hemiplegia was found, and one each facial paralysis, paresis of one arm, and paralysis of the sphincters alone.

Hemiplegia occurred in one when the hemorrhage was over both hemispheres, nine times when but one hemisphere was affected, three times when the hemorrhage was in the brain substance as well as on the surface, twice when in the substance alone, and twice with the hemorrhage in the lateral ventricles.

The pupils were dilated in seventeen on the same side as

the hemorrhage, in eight on the opposite side; and contracted in seven on the same side, in six on the opposite side; they were normal and reacted in eighteen out of seventy-six where this symptom was noted, and "sluggish" in nine.

The connection between the internal hemorrhage and the elapsed time between the injury and death is of some interest.

It will be noticed that there were five cases of immediate death; in all of these there was hemorrhage into the ventricles, in three it was limited to the ventricles, and in two associated with moderate hemorrhage in the brain substance or on the surface. There were eight other cases in which the ventricles were affected; of these four lived less than twelve hours, and four from one to four days.

Of these one hundred and forty-three cases, $50\frac{3}{10}$ per cent. lived less than twenty-four hours, $22\frac{3}{10}$ per cent. between one and three days, $17\frac{4}{10}$ per cent. from three to seven days, and $9\frac{7}{10}$ per cent. lived more than seven days.

	Died in less than twenty-four hours.	Died in from one to three days.	Died in from three to seven days.	Lived more than seven days.
Hemorrhage over both hemispheres	$60\frac{8}{10}\%$	$30\frac{4}{10}\%$	$4\frac{3}{10}\%$	$4\frac{3}{10}\%$
Hemorrhage over one hemisphere	$47\frac{3}{10}\%$	21%	$19\frac{7}{10}\%$	$11\frac{8}{10}\%$
Hemorrhage over surface and into substance	$43\frac{4}{10}\%$	$21\frac{7}{10}\%$	$21\frac{7}{10}\%$	$13\frac{4}{10}\%$
Hemorrhage into brain substance	25%	$12\frac{5}{10}\%$	$37\frac{5}{10}\%$	$12\frac{5}{10}\%$
Hemorrhage into ventricles	$69\frac{2}{10}\%$	23%	$7\frac{8}{10}\%$	

There were one hundred and eighteen cases where the condition of the brain and the age of the patient were noted.

No involvement of brain substance	20
General severe laceration	6
Slight laceration of meninges	21
Considerable laceration of meninges	13
Severe laceration of meninges	2
Slight laceration of base	22
Considerable laceration of base	29
Severe laceration of base	5
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Under the age of thirty there were three cases where there was no laceration of the brain substance, in three there was great general laceration, in fourteen there was slight laceration of the meninges, in six there was considerable, in eight there was slight laceration of the base, in six there was considerable, and in one the laceration was severe.

Between thirty and fifty there were fifteen cases where there was no laceration, and in two the laceration was general, in thirteen there was slight laceration of the meninges, in nine considerable, and in one severe; in fourteen there was slight laceration of the base, in fourteen considerable, and in three the laceration of the base was severe.

Of those who were over fifty, two had no laceration of the brain substance, in one it was general.

One hundred and fifty-eight cases were found in which both the character of the accident and condition of the brain at the autopsy were noted.

Laceration of base	6
Laceration of base and compression	39
Laceration of meninges	11
Laceration of meninges and compression	58
General laceration	9
Compression	20
Laceration and sepsis	13
Sepsis without laceration	2
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It will be noticed that there were only twenty-two cases in which there was absolutely no laceration of the brain substance found. Included here under the head of laceration are many cases where the injury to the brain substance was so slight as to have no bearing on a cause of death.

There were twenty-one cases of gun-shot wounds; of these, ten were lacerated along the track of the bullet alone, and eleven had sufficient hemorrhage to cause cerebral compression. There were two where laceration was followed by sepsis.

In thirty-five the accident was unknown, nearly all being found unconscious, either on the street or in buildings, and it is probable that most of these were either the result of direct violence, or of falls from one cause or another. It will be noticed that in these unknown cases the effect upon the brain was very similar to those which resulted from direct violence and falls upon the street.

Of this class there was one each of laceration of the base and laceration of the meninges; eleven, or $31\frac{4}{10}$ per cent., had laceration of the base and compression, seventeen, or $45\frac{7}{10}$ per cent., laceration of the meninges and compression, while in five there was compression without laceration; twelve were struck by trains or rapidly moving electric-cars; laceration of the base and laceration of the meninges alone were found in one each; in one there was great general laceration, six laceration of meninges and compression, two compression without laceration, and one sepsis following laceration.

Thirty-five were the result of direct violence; there was one each of laceration of the base, laceration of meninges, and general laceration, five laceration of the base and compression, thirteen laceration of meninges and compression, and five with compression alone; there were nine cases of sepsis, in only one of which was no laceration of the brain substance found.

Twenty-three followed falls downstairs; of these, there were three of great general laceration, one of laceration of the meninges without compression, and four of compression without laceration, five laceration of meninges and compression, nine laceration of base and compression, and one laceration and sepsis.

Eleven fell while walking on the street, striking their heads on the ground or pavement. Nine were followed by laceration of the brain and compression, one by general laceration, and one by compression alone.

Eight fell short distances, all less than twenty feet, four were followed by cerebral laceration and compression, and one each of general laceration, compression alone, sepsis following laceration, and sepsis without injury to the brain.

There were thirteen cases the result of very severe falls or crushes; of these, two were followed by laceration alone, seven by laceration and compression, two by general laceration, two by compression alone, and two by sepsis following laceration; four had slight laceration of the meninges, one considerable, and one severe; four had slight laceration of the base, eight considerable, and two severe.

The condition of the brain and the time elapsing between the accident and death were noted in one hundred and thirty-five cases. Included here under the head of laceration, however, are many cases where the injury to the brain substance was so slight as to have no bearing as a cause of death. Where laceration of the base alone was found, one died in six hours, one in eighteen, one in two days, and three in from one to three days. Where there was compression as well, two died at once, four in six hours, five between six and twelve, and eleven between twelve and twenty-four; eight lived from one to three days, five from three to seven days, and three from seven to fourteen days.

With laceration of meninges alone, five died in less than six hours, two from six to twelve, and two in from twelve to twenty-four; one lived five days, one lived nine. When associated with compression, four died in less than six hours, seven from six to twelve, fourteen from twelve to twenty-four, fifteen lived from one to three days, six from three to seven, one thirteen days, and three from fourteen to twenty-one.

Of the two cases of septic meningitis, one died in six days and one in nineteen. When laceration was associated with sepsis, five died in from three to seven days, four from seven to fourteen, one in twenty days, and two lived for more than three weeks.

Of the eight cases of general laceration, two died in from six to twelve hours, two in from twelve to twenty-four, and four lived from one to three days.

Of the eight cases of pure compression, two died in six to twelve hours, three in twelve to twenty-four, and two in from one to three days.

The effect of the accident upon the brain has been noted; but as in many cases the condition of the brain does not represent the cause of death, it will be of some interest to notice the relation of the accident to the immediate cause of death. Of these cases there were one hundred and sixty-five, death being due to:

Concussion	in	1
Compression	"	54
Laceration	"	24
Concussion and laceration	"	4
Compression and laceration	"	46
Shock	"	2
Sepsis	"	15
Multiple injuries	"	10
Intercurrent disease	"	4
Hemorrhage into ventricles	"	5
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There were twenty-five cases of gun-shot wounds; of these, thirteen died of laceration, four of compression and laceration, two of sepsis, one of multiple injuries, five hemorrhage in the ventricles.

Five were run over on the street; four died of multiple injuries, and one from concussion and laceration.

Twelve fell while walking on the street; five died of cerebral compression, six from compression and laceration, and one from concussion and laceration.

Four fell more than thirty feet; and one died each of compression, laceration, compression and laceration, and multiple injuries.

Twenty-three fell downstairs; of these, seven died from compression, four from laceration, nine from compression

and laceration, and one each from sepsis, intercurrent disease, and hemorrhage in the ventricles.

Thirty-seven were due to direct violence; one died from cerebral concussion, fifteen from compression, one from laceration, one from concussion and laceration, eight from compression and laceration, one from shock, nine from sepsis, and one from hemorrhage into the ventricles.

Thirteen were struck by trains; four died from compression, one from concussion and laceration, one from sepsis, four from multiple injuries, two from intercurrent disease, and one from hemorrhage into the ventricles.

Eight fell varying from three to twenty feet; of these, three died from compression, one from laceration, one from compression and laceration, two from sepsis, and one from intercurrent disease.

Five were thrown from moving wagons or horse-cars; two died from compression, one from laceration, and two from compression and laceration.

The accidents in thirty-six were unknown, but for the reasons before stated were probably in by far the greater number either due to direct violence or falls of a short distance; of these, seventeen died from compression, three from laceration, fifteen from compression and laceration, and one from shock.

The time elapsing between the accident and death, together with the cause of death, was noted in one hundred and sixty-two cases.

There were but two in which concussion was alone found; one of these died in eight and one in twenty hours.

There were sixty-two in which death was directly due to cerebral compression; in two where the hemorrhage was in the ventricles death occurred at once; six died in less than six hours, ten in from six to twelve, and sixteen in from twelve to twenty-four; thirteen lived from one to three days, nine from three to seven days, two from seven to fourteen, and four from two to four weeks. The most rapid death from compression in which the ventricles were not involved was in one hour, and the longest survival where death resulted from compression alone was twenty days.

Twenty-six died from laceration of the brain substance; of these, five died in less than six hours, five in from six to twelve, and five in from twelve to twenty-four; seven lived from one to three days, three from three to seven, and one lived twelve days.

In forty-three cases death was due to combined cerebral compression and laceration; two died in less than six hours, five in from six to twelve, sixteen in from twelve to twenty-four; twelve lived from one to three days, six from three to seven, and two from seven to fourteen days.

There were but two in which shock must be given as the cause of death, and it is at least possible that in these cases a more thorough or microscopical examination would have revealed sufficient cause for death in minute laceration or other disturbance of the brain tissue, and in this way the employment of that extremely loose term might have been avoided; both of these cases died in less than seven hours.

In fourteen either a purulent meningitis or cerebral abscess was found, and death was due to sepsis; six died in from three to seven days, four in from seven to fourteen, two in from fourteen to twenty-eight, and two lived for more than twenty-eight days. The most rapid death from sepsis was in seventy-two hours, while life was prolonged in one case for seventy-two days.

Of these deaths from sepsis, the injury was in eight compound and in six simple; of those which were simple, one was a separation of the sagittal suture, one fracture into the frontal sinus, and three were fractures through the petrous portion of the temporal bone; of the compound fractures, five were trephined and one was a gun-shot wound.

There were eight deaths from multiple injuries; two died in less than one hour, five in from one to six hours, and one lived for three days.

In five death was due to intercurrent disease; four being from pneumonia, three of which were bronchial in character. All of these cases died in from one to seven days.

Injury to the cerebral substance or hemorrhage by "Contra Coup.," was found in twenty-three cases.

The following table will show the age of the patient and the character of the accident:

Under 10.	Fell on street.	Fell from great height —30 feet +.	Fell down-stairs.	Direct violence.	Struck by train, etc.	Unknown.	Total.
10–20	0		0	0	0	0	0
20–30	0		0	1	0	3	4
30–40	2		0	3	1	2	8
40–50	0		2	0	0	3	5
50–60	1		1	0	0	2	4
Over 60.....	1		1	0	0	0	2
Total.....	4	0	4	4	1	10	23

SUMMARY.

Localized fractures of the skull are rare. Of the cases here reported, which do not include the most severe, 12 per cent. were localized.

Localized fissures of the vault or base are very rare. After omitting the nine cases of localized depressed fracture, we find six localized fissures of the vault and three of the base, or $6\frac{6}{10}$ per cent. of fissures not extending.

Out of the whole number of cases the base was involved in 89 per cent., divided as follows:

Anterior fossa, 32 per cent. Middle fossa, 83 per cent. Posterior fossa, 31 per cent. The fracture was limited to a single fossa in 51 per cent., to two fossæ in 32 per cent., while all three fossæ were affected in 8 per cent. The fracture was in 41 per cent. of all basal fractures, which number one hundred and thirty-one, limited to the middle fossa. In all but two of these the meningeal artery was injured, and the hemorrhage resulted.

By far the most common fracture was one starting in the parietal bone, and running either in or across the middle meningeal groove, through the middle fossa, ending in either the foramen rotundum or ovale.

All the localized fractures occurred in patients under forty years of age.

In so far as this number of cases has any bearing they tend to show the unreliability of those objective symptoms which are generally considered of diagnostic value. There was hemorrhage from the nose in $46\frac{1}{2}$ per cent. of all fractures of the anterior fossa, and in 20 per cent. of fractures not involving the anterior fossa; from the mouth in $9\frac{1}{3}$ per cent. of fractures of the anterior fossa, and in $15\frac{1}{2}$ per cent. where the anterior fossa was not involved.

Subconjunctival ecchymosis was found in $9\frac{1}{3}$ per cent. of fractures of the anterior fossa, and in $13\frac{1}{2}$ per cent. of all others. Hemorrhage from one or both ears was present in $37\frac{3}{5}$ per cent. of fractures of the middle fossa, and in $10\frac{1}{4}$ per cent. of all others. There was no external hemorrhage in 36 per cent. of all fractures of the anterior fossa, and in $30\frac{9}{10}$ per cent. of fractures of the middle fossa.

The question of paralysis was considered in sixty; of these, forty had no paralysis or paresis that could be determined.

The pupils were dilated on the same side as the internal hemorrhage in seventeen, on the opposite in eight; contracted in seven on the same side, and six on the opposite; they were normal in eighteen out of seventy-six.

Of the whole number of cases 50 per cent. died in less than twenty-four hours, 22 per cent. in one to three days, 17 per cent. in three to seven days, and 9 per cent. lived more than seven days.

Shock as a cause of death, in fractures of the skull at least, is extremely rare; of the whole number of cases reported, *i.e.*, one hundred and sixty-nine, there were but two where no other condition sufficient to cause death could be found, and one at least of these was in a man of over seventy years, who was assaulted and suffered from multiple bruises as well as his cerebral injury.

In railroad and electric-car accidents, where shock is most often given as the direct cause of death, all the autopsies showed lesions in themselves sufficient to cause death.

In ten of these cases there were multiple injuries found which had not been suspected during life, but which were the

direct cause of the condition which was considered as shock, as well as the cause of the patient's death.

Sepsis was found in fifteen cases, and in several where there was no compound injury, and where the infection may have come from either the frontal sinus or auditory canal.

As a help to the more accurate diagnosis of cerebral injuries the foregoing cases have little to offer; their bearing from a surgical aspect is, however, of more importance.

The internal hemorrhage was in 71 per cent. of one hundred and forty-three cases limited to the surface of the brain. In only 21 per cent. of these was there absolutely no involvement of the brain substance.

The cause of death, however, was cerebral compression in 53 per cent., and including the five cases dying of sepsis after operation; nearly 58 per cent. of the cases where the hemorrhage was limited to the surface; nearly 35 per cent. of the whole number of autopsies.

Fracture of the vault extending into or through the middle fossa, with rupture of one of the branches of the meningeal artery, followed by death from cerebral compression or sepsis following operation, occurred in forty-two, or nearly 25 per cent., of all cases, including bullet wounds and separation of sutures; when these are excluded, as they may be, we find that 29 per cent. of all cases belong to this class.

The very large percentage of deaths from cerebral compression is certainly surprising, as are the number where that compression is due to rupture of the meningeal arteries.

If these figures mean anything, they would justify very much more radical surgical interference than has been considered advisable, certainly by surgeons with any tendency toward conservatism.

XIV.

AN EXTRACTOR FOR THE REMOVAL OF INTUBATION TUBES.

By Edward H. Nichols, M.D.

Much of the difficulty experienced in removing intubation tubes is due to the mechanically faulty construction of the extractor in general use. The "grip" is weak and uncertain; the curve of the instrument is unnecessarily long; danger of laceration is great, because the jaws open at a wide angle; and manipulation of the instrument is unnatural and awkward.

The problem is to lift a "bell muzzled," rigid metallic tube, having nearly parallel sides, by means of rigid jaws applied to the inside of the tube. The difficulty of the problem is increased by the small size of the lumen of the tube, compared with that of the corresponding larynx, and by the presence of much slimy mucus.

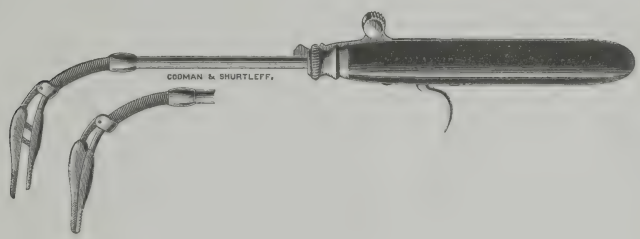
The ordinary extractor endeavors to lift the tube by means of jaws that open practically like those of a pair of scissors, thereby applying pressure at two narrow points only, and giving a weak grip on the tube.

The curve of the instrument is so long that, when an attempt is made to lift the tube, the curve of the instrument generally strikes the hard palate, and the tube often slips off from the extractor. Even if the tube is held fast it is difficult to "turn" the tube out of the larynx.

The jaws of the instrument open at a wide angle, consequently very great laceration of the soft parts may be caused by slipping of the extractor, or by accidentally opening the jaws outside of the tube.

The manipulation of the tube is awkward. It is not easy to lift the tube and at the same time maintain firm pressure with the thumb. The thumb instinctively relaxes its hold on the lever, and the tube slips.

The instrument illustrated in the cut was devised to lessen, if possible, the difficulties of the operation. It has been used for several months in the diphtheria ward of the Boston City Hospital, and has been very satisfactory.



The larger cut shows the instrument open, the smaller one shows the jaws closed, ready for introduction. The jaws are opened by pressure of the thumb, the manipulation being exactly like that for disengaging the tube from the introducer, except that much firmer pressure is required. A spring concealed in the handle automatically closes the jaws.

By an arrangement like that of a parallel ruler, the jaws, instead of opening at an angle, open parallel to each other, and give a long bearing-surface to be applied to the inner surface of the tube. This gives so firm a grip that a tube once seized by this instrument has never slipped in the experience at the Hospital.

The operator can tell surely when the jaws are in the tube. Open the jaws slightly, with gentle pressure, when, if they are in the tube, they "bring up" suddenly ; then firm pressure can be applied and the tube removed.

Failure to feel this sudden resistance shows that the jaws are not engaged in the tube, but, as they open parallel to each other, the danger of severe laceration is much diminished.

The curve is considerably shorter than the usual one,

making it possible to lift the tube clear of the larynx without striking the hard palate, with the risk of losing the tube.

The action is simple and natural. The hand instinctively takes the position for operating.

The grip is firm and sure, manipulation is simple, and possible laceration is avoided.

XV.

A REVIEW OF NINETY-TWO CASES OF DISEASE OF THE HEART OBSERVED IN THE OUT-PATIENT DEPARTMENT OF THE BOSTON CITY HOSPITAL.

By Henry Jackson, M.D.

Many cases present themselves for diagnosis and treatment in an out-patient clinic, with symptoms suggestive of some disturbance of the circulation, as dyspnœa, cough, œdema, or inability to work, in whom the diagnosis may be more or less difficult. Many of the difficulties may be removed if the physician directs his attention to a careful consideration of the size of the heart, to the relative proportion of the cavities and the muscular tissues of the heart, to its regularity of action and force, rather than to the presence or absence of endocardial murmurs. Again, many cases are found to have some disease of the heart, more often valvular, but occasionally of the substance of the heart, which present no symptoms of such trouble, and in which a careful examination of the history may not elicit any symptom suggestive of cardiac trouble. As a matter of fact, a valvular lesion in itself gives rise to no untoward symptoms, causes no inconvenience to the individual, until as a result of the pathological change, of the incompetency of the affected valve, the heart becomes so dilated and the muscular tissues so weakened that it is no longer capable of supplying the system with properly oxygenated blood. During the stage of compensatory hypertrophy, as long as the defect in the valve is overcome by the increase in the muscular force, the disease is not suspected by the patient, and a diagnosis of the condition is made only by chance. Practically, from a therapeutic standpoint we do not treat the valvular lesion, but can help our patient only in so far as we are able to

assist the heart to overcome the difficulties dependent upon the defect of the valve.

Clinically, disease of the heart may be divided into three essential classes: valvular, dilatation and hypertrophy, functional. Aside from the cases of dilatation or hypertrophy of the heart dependent upon valvular lesions, many cases are observed in which it is difficult and often impossible to determine the etiology during life. From some cause or other the muscular substance becomes weakened, and secondarily there follows a gradual enlargement of the cavities, with diminution in the thickness of the walls. The dilatation may be dependent upon fatty degeneration, fatty overgrowth (infiltration), some disease of the myocardium dependent upon obstruction of the coronary arteries, or may be met with as the result of prolonged overwork or alcoholic abuse. Again, the enlargement may be dependent upon arterio-sclerosis or renal disease.

The nomenclature of these various conditions is unsatisfactory; it cannot be based upon a probable pathological process, as in most cases this cannot be determined during life. In hospital records such cases are often entered as "Cardiac" or "Heart," etc.; and many death-certificates signed "Heart Failure" might be more properly characterized as dilatation of the heart. It seems to me that the term "parietal disease of the heart," suggested by Dr. W. W. Gannett in a paper read before the Clinical Section of the Suffolk District Medical Society in March, 1893, is applicable to a large number of such cases. It expresses tersely and exactly the condition of the heart without committing one to an opinion as to the cause of the difficulty.

During two services of four months each, the one in the summer and the other in the spring, ninety-two cases were seen in which the heart was principally or only at fault as a cause of the symptoms complained of.

In forty-eight cases no valvular lesion was found as a factor in the production of the heart trouble; and these may, I think, be properly classified as "parietal disease of the heart." In these cases the diagnosis of some disease of the muscular substance of the heart was based upon a modification of the size of the heart, together with more or less

disturbance in its action, as determined by enfeebled action, increase of rate, irregularity in rate or rhythm, or intermittency. Undoubtedly, in a certain proportion of these cases post-mortem examination would show some valvular disease. Further, in certain cases a first sound that I describe as short and valvular would by some observers be considered as accompanied by a murmur; but in none of the cases was there a murmur defined in character, or localized with sufficient accuracy to warrant the diagnosis of a specific valvular lesion.

Five of the cases were classified as functional. In all the symptoms were palpitation and pain in the cardiac region; one, a man, said he "was afraid to work on account of his heart." In three, excess in tea, and in two, excess in tobacco, was assigned as the cause of the trouble. Two were young men of eighteen, and three young women. In all these cases physical examination showed a rapidity of action, but no modification in the size of the heart or in the strength of the pulsations. The diagnosis of "Functional Disease" may here, as in so many other cases, be merely a mask to cover our ignorance as to some hitherto unexplained pathological change; but at the present time we can only assume some disturbance of the nerves regulating the action of the heart, as we have no evidence of any other pathological condition. In thirty-nine cases there was some valvular defect.

The large proportion of cases of some heart trouble which present no evidence of valvular lesion shows us the importance of a careful consideration of the diseases of the parietes of the heart; a classification of the symptoms presented by such cases is interesting; and a uniform nomenclature, if obtainable, is certainly desirable.

FORTY-EIGHT CASES OF PARIETAL DISEASE OF THE HEART.

Thirty-six were men, ten were women, and two boys (aged respectively six and ten years). One of the boys had just recovered from diphtheria, and came in with a complaint of pain in the chest and palpitation. Examination showed an enlargement of the heart; the apex was outside the line

of the nipple; the pulmonic second sound was accentuated; there was a slight soft systolic murmur, not transmitted, heard at the base. Here a diagnosis of fatty degeneration might be with propriety considered. The other boy, ten years of age, complained of loss of flesh, general debility, and poor appetite; he had never been strong. Examination showed an enlargement of the heart; the apex was just within the line of the nipple, and the action was violent. Though no murmur was present, congenital deformity was suspected, though impossible of diagnosis. The age of the other cases was as follows:

9 cases, 30 to 40 years.
13 cases, 40 to 50 years.
7 cases, 50 to 60 years.
10 cases, 60 to 70 years.
5 cases, 70 to 80 years.

Where noted, the symptoms which caused the patients to apply for relief had existed for the following periods:

12 cases, 3 to 4 years.
9 cases, 1 to 2 years.
7 cases, several weeks.
9 cases, several months.
2 cases, 10 and 14 years respectively.

Seven cases were seen which presented no symptoms referable to the heart, but came in on account of some general disease; as one for herpes zoster, a second on account of a mastoid abscess, a third for some trouble with the eyes.

The symptoms complained of were as follows:

16 cases, pain in the chest, sometimes referred to the region of the heart, more often not localized.
22 cases, dyspnœa or shortness of breath.
7 cases, cough.
8 cases, palpitation.
4 cases, dizziness.
4 cases, general weakness.
2 cases, sudden attacks of faintness.
7 cases, œdema.

The most frequent and prominent symptoms were dyspnœa and distress, or sharply defined pain in the chest, symptoms which in many instances had existed for a long time, and often prevented the patients from doing their usual work. In none of the cases was œdema a marked feature, and in only a very few was albumen noted as present in the urine. In a few of the cases palpitation was given as the essential symptom which caused the patient to seek for advice.

Etiology. — In twenty-three cases no definite cause could be assigned for the condition of the heart. In ten the confession was made of excess in alcohol, and it is probable that a good many more had used alcohol in large quantities, as patients are not inclined to make this admission to a house-officer. Seven patients had acute or chronic rheumatism. An examination of the age of the patients shows that all of them were in middle life, or past that period.

Physical Examination of the Heart. — In all the heart was enlarged, and the apex seen or heard, or both, outside of the line of the nipple. In one case the area of cardiac dulness extended two inches to the left of the line of the nipple. Irregularity of the action of the heart was noted in thirteen cases, and irregularity with intermittency in eight cases. In seven cases rapidity alone was noted, while in fourteen cases the only abnormal auscultatory sign was a marked feebleness of the pulsations, with a short valvular sound at the apex instead of the booming sound usually heard with the first sound at this place. I give a few typical cases:

Case I. Man, fifty-three years of age. Complained of pain in the right chest. Dyspnœa for three or four years. Had been addicted to the abuse of alcohol. The heart was enlarged, irregular in force and rate, and the sounds were weak.

Case II. Man, forty years of age. Complained of vertigo, slight dyspnœa on exertion, general malaise; was unable to work. Symptoms had existed for about a year. No cause could be assigned for his trouble. Heart was enlarged one-half inch to the left of the nipple line; the apex was seen and felt just beneath the nipple. Action of the heart occasionally irregular; first sound short, faint, and valvular.

Case III. Woman, forty years of age, a seamstress. She had noticed shortness of breath and palpitation for two years, which had interfered with work. No cause could be assigned for the trouble. There was slight enlargement of the heart; its action was very irregular in rate and rhythm. There was slight œdema of the legs; no albumen was found in the urine. It is possible that in this case there may have been a stenosis of the mitral valve, but the absence of any history of rheumatism or any abnormal sounds at the mitral valve renders the diagnosis at least doubtful.

THIRTY-NINE CASES OF VALVULAR LESIONS OF THE HEART.

Men, twenty-six cases; women, ten cases; children, seven to ten years of age, three cases. The duration of the symptoms, when noted, was as follows:

5 cases, several weeks.
10 cases, several months.
4 cases, a year or more.
6 cases, 2 to 3 years.
5 cases, several years.
2 cases, 8 and 15 years respectively.

In seven cases no symptoms were presented suggestive of any cardiac trouble. One case came in on account of gonorrhœa; another, who complained only of pain in the lumbar region, had a mitral regurgitation, with an enlarged heart in which hypertrophy was the essential factor in forming the increase of size. Fifteen years ago, when a boy, he had acute articular rheumatism.

In some of the cases the symptoms which brought the patients to the clinic had been noticed only for a few weeks; others who engaged in hard labor had suffered more or less for many years.

The symptoms complained of were these:

7 cases, a sense of pain or distress in the cardiac region.
15 cases, dyspnœa.
7 cases, cough.
4 cases, dizziness.
2 cases, œdema.

It is extremely interesting to note the ability to work as an index of the effect of the cardiac lesion on the individual. Only seven had given up their work on account of dyspnœa or shortness of breath; while, as stated, seven made no mention of symptoms suggestive of any cardiac disease. Only two of the men were engaged in light work, the others being day-laborers, or otherwise employed at hard, manual labor. Several of the patients who had marked valvular defects with great increase in the size of the heart were actively employed in hard labor. One case is especially noteworthy, that of a blacksmith, twenty-five years of age. He complained of dyspnœa on exertion, and a considerable swelling of the body and extremities, which had existed for several months. He had acute articular rheumatism two years before he was seen at the out-patient department. Physical examination showed pallor and cyanosis; the heart was enlarged two inches to the left of the nipple; there was a loud double murmur at the base, a systolic murmur at the apex and in the tricuspid area. He came to the out-patient department for several months; and during all this time continued to support his family as a blacksmith.

Such an analysis of cases shows us very vividly that because a man has valvular heart-disease he is by no means to be considered incapable of working, and may live in comfort for many years, as in several instances the rheumatism which appeared to be the etiological factor of the disease had occurred many years before the patients were seen at the clinic.

Etiology. — In fourteen cases, no cause assigned; in sixteen cases, acute articular rheumatism; in seven cases, chronic rheumatism.

A boy of ten years was seen who had never had rheumatism or any acute infectious disease. He came in on account of epistaxis, but the mother said that he had never been "rugged." There was great enlargement of the heart, with violent action and a pre-systolic and systolic murmur.

The following forms of valvular lesion were seen:

16 cases, mitral regurgitation.

9 cases, mitral obstruction and regurgitation.

1 case, mitral obstruction.
5 cases, aortic obstruction and regurgitation.
4 cases, aortic and mitral regurgitation.
1 case, aortic and tricuspid regurgitation.
1 case, aortic regurgitation.
1 case, aortic stenosis and mitral regurgitation.
1 case, aortic stenosis.

XVI.

SURGICAL ABSTRACT.

By Abner Post, M.D.

With each volume of reports issued by the City Hospital has appeared an article entitled "Surgical Abstract." Under this heading have been considered certain portions of the work done during the time covered by the report.

The amount of surgical work is so great, and divided among so many different surgeons, that no one man can know all that has been done; and anything like a proper digest of the work done during the preceding five years would require long and serious study of the records. There are, however, many cases which deserve mention, and certain subjects which may be treated in brief rather than passed by.

AMPUTATIONS.

Each report has contained some mention of the major amputations. The number of such amputations during the last five years is seventy-nine, as is shown by the accompanying table. Three cases in which a double amputation was done have been given separately, as it seems very proper to do. There is reason to suppose that in some of the former reports of the Hospital such cases of double amputations have been included without explanation in the tables, and in some cases as two separate amputations. In considering the deaths from amputations, such double amputations may fairly be considered as a class apart. In comparing the present table with tables of earlier years from our own Hospital, it seems fairer to the tables of preceding reports to include them. The total number of amputations, then, for comparison with preceding years, is eighty-two.

So much is said about the saving of limbs by modern methods, that it seemed desirable to make some sort of comparison between the figures of the present table and those of previous years. A comparison of the mortality of the amputations of the first and the last five years shows certain very striking differences. In the five years included in the first report there are tabulated 137 amputations. Five of these were of the foot, which have not been included in subsequent tables and ought to be disregarded; this would leave 132 major amputations. During that five years the number of surgical patients was 2,997. An amputation was done on one patient out of every twenty-three patients who entered the Hospital for surgical disease or injury.

Of these 132 amputations the result in one case was unknown, as the patient was removed from the Hospital at a time when his death was probable. Of the 131 cases, 54 were fatal, a percentage for all cases of .4122. This mortality was considered large at the time.

The number of operations performed in the first five years is tabulated as 1,113. Of the operations then, one in nearly nine was a major amputation.

During the five years 1889–1893, inclusive, there were admitted to the Hospital 14,689 surgical patients. During that time the number of patients who suffered amputation was eighty-two, so that the relative number of amputations had fallen from one amputation in twenty-three surgical patients to one in every one hundred and seventy-nine patients.

The number of operations in the last five years is approximately 6,170, not including the operations in the gynæcological and contagious services. There was therefore one amputation in every seventy-five operations, instead of one in nine, as in the first five years.

As has been already noted, the surgical population of the Hospital has increased from 2,997 during the first five years to 14,689 during the last five years — an increase of fivefold very nearly.

Had the amputations increased in the same ratio as the patients, we should expect to find a record of very nearly 660 amputations during the last five years, instead of 82,

and the same rate of mortality would have given us a death record of over 250.

It is not easy to explain this great change. An enthusiast might be tempted to ascribe it all to the change in surgery wrought by antiseptics, but other causes must be considered.

The question has been raised whether the accidents of the present day as a result of the increased weight of machinery and of rolling-stock are not more immediately fatal than they were thirty years ago, so that at the present time we have a larger number of immediate deaths from accidents; and that those who survive the immediate effects of the accident require operations of less severity. Such a question can be accurately answered, if at all, only after a very careful study of the records; but a change in the method of treating accidents which threaten the integrity of limbs has certainly taken place which might suggest that accidents requiring amputation were less severe. It may truthfully be said that the character of the amputations has undergone a transformation. It is no longer necessary to go so far above the site of the original injury as it was formerly. Suppuration is not as likely to extend to skin slightly abraded or partially torn from the underlying stuctures, so that the accidents of the first five years would, at the present day, require amputations of less severity.

The amputations at the shoulder joint seem to confirm this view. In 1864–69 there were eleven amputations at the shoulder joint; one was pathological, ten for traumatism. Nine are given as compound and comminuted fractures of the shaft of the humerus, one as compound fracture of humerus. In four there is additional mention of fracture into the elbow joint. The portion of the shaft broken is not given. There were six other cases of compound fracture of the humerus that were treated in a less radical manner; one of them dying within forty-eight hours without operation. So far as can be made out from the report of these cases, there is nothing to show that they were any more severe than cases tabulated as compound fractures of the humerus at the present day; and these would be amputated, if at all, through the shaft rather than at the shoulder.

Of the total of sixteen cases of compound fractures of the humerus, ten died.

Undoubtedly there has been a change in surgeons. Of the operating staff of the first five years, but one still continues to fulfil the duties of the place. The years in question included the latter part of the war, and the surgeons were, of course, influenced by the lessons of the time. An amputation was by many considered as the more conservative measure. Surgeons were undoubtedly more ready to amputate than now. The suppuration which so readily followed injury, with its attendant fever, made a clean amputation above the injured structures safer, in a large majority of cases, than waiting.

In reference to this matter Dr. Cheever, speaking of amputation of the thigh for injury, in the Surgical Abstract in the first report, writes as follows: "The surgeon, unfortunately, has no alternative but to operate, since he cannot wait for suppuration and a secondary amputation without more than endangering life."

There was formerly a difference in the character of surgeons so far as the preservation of limbs was concerned. Individual characteristics must always show themselves in surgical as well as in other work; but the great change in surgeons is due to their greater ability to control the evils which were once thought to be almost inseparable from traumatism and its consequences. This change in surgeons must be looked upon as the result of existing conditions, rather than the cause.

It has been very truly said that one of the very great advantages of present methods in traumatic surgery lies in the fact that it is now possible to disinfect many wounds and wait for the patient to rally; or even for the extent of the injury to fully declare itself by the death of the parts which are too greatly injured to recover, before proceeding to their removal, without seriously endangering life.

In other words, secondary amputations do not at the present day add so greatly to the danger to life as formerly. Perhaps the amputations of the upper arm will illustrate the conditions of thirty years ago. In the years 1864–69, as shown in the first report, the arm was amputated twenty-

seven times. Of these cases sixteen recovered, with an average convalescence of forty-three days. In one case the result was unknown. Ten died; a mortality of thirty-eight per cent.

Of the ten deaths pyæmia was noted in six cases, and erysipelas also in one. In one case there was secondary hemorrhage.

Of the sixteen cases that recovered there were in one case repeated abscesses; in one erysipelas; in one secondary hemorrhage; in two phagedena; in one slight phagedena. The case in which the result was unknown was taken from the hospital, suffering from "rigors and modified symptoms of pyæmia."

It seems fair to say, after considering other influences, that while the diminution in the number of amputations and in the mortality may be due to more than one cause, the most probable explanation of the change is the difference in treatment, which allows the choice of the most advantageous moment for operation, which reduces the portion removed to a minimum, and renders pyæmia the rarest of complications.

Statistics of the Major Amputations (82) at the Boston City Hospital (1889-1894).

Place.	Traumatic Primary.				Traumatic Secondary.				Pathological.				Grand Total.			
	Recovered.	Died.	Total.	Per cent. Mortality.	Recovered.	Died.	Total.	Per cent. Mortality.	Recovered.	Died.	Total.	Per cent. Mortality.	Recovered.	Died.	Total.	Per cent. Mortality.
Hip									1	1	2	50.00	1	1	2	50.00
Thigh	2		2						12	2	14	14.28	14	2	16	12.50
Knee						1	1	100.00	1		1		1	1	2	50.00
* Leg	16	1	17	5.92	7		7		9	4	13	30.70	32	5	37	13.50
Ankle	2		2		1	1	2	50.00	1		1		4	1	5	20.00
Shoulder	1	1	2	50.00						1	1	100.00	1	2	3	66.66
Arm	3		3		3		3						6		6	
Elbow									2		2		2		2	
* Forearm	3		3		2	1	3	33.33					5	1	6	16.60
Total	27	2	29	6.89	13	3	16	18.75	26	8	34	23.50	66	13	79	16.45
* Double Amputations.																
Forearm		1	1	100.00										1	1	100.00
Leg	1	1	2	50.00									1	1	2	50.00
Total	1	2	3	66 66									67	15	82	18.29

The following cases of removal of the tonsil for malignant disease illustrate the advantages of the operation described by Dr. Cheever.

Case I.— A Maine lumberman, forty-one years of age, had never been sick until a year previous to his entrance to the hospital. He had first noticed a "thickness of speech," accompanied, he thought, by swelling of the tongue. There had never been any pain on swallowing, and the only troublesome symptom had been a headache, usually occipital, which had sometimes been severe enough to prevent sleep. He had had a slight cough, accompanied with a scanty expectoration, but without blood. During this past year he had lost fifty pounds in weight.

On entrance his condition was described as follows: "There is an evident thickness of speech, as if some foreign body were held in the mouth. On the right side of the oral cavity can be seen a red glistening tumor which seems to push the tonsil forward. Below the angle of the jaw on this side there is a fulness, as compared with the opposite side. The nostrils are free."

The patient entered the hospital December 10, 1889, and was operated upon by Dr. Cheever four days later. Ether was given, the patient sitting in a chair, with the body at an angle of 45°. Thread passed through the tongue. A curved incision beginning just anterior to the styloid process, and running downward and forward, to terminate over the jaw anterior to the insertion of the masseter muscle. No other incision was necessary. The flap of the skin was raised, the parotid gland turned up, the submaxillary gland turned down, the facial artery and external jugular vein ligated, and the mylo-hyoid muscle divided. The periosteum at the angle of the jaw was divided and retracted, and the bone sawn through, after holes had been drilled on each side and wire passed through. During this manœuvre, an opening was accidentally made into the mouth through the buccinator and constrictor muscles. The gustatory nerve was not seen. By the aid of the wires the divided ends of the bones were everted and lifted up, thus uncovering the styloid group of

muscles. The glosso-pharyngeal nerve was not seen or approached.

With one finger in the mouth and the other in the bottom of the wound, the tumor could now be plainly felt, and seemed the size of half a lemon, being covered only by the superior constrictor. This was carefully cut through, and the tumor found to be of a soft material. Dissection was now carried in along the retro-pharyngeal space, partly with the director, but mainly with the finger. It was perfectly easy to separate the muscular sac of the pharynx from the pre-vertebral region. The tumor was covered apparently by the pre-vertebral fascia, and was immovable. In length it extended up to the vault of the pharynx, and down to the top of the arytenoid cartilages.

It filled half the pharynx on the right side, extending from the middle line to neighborhood of the internal carotid artery, which vessel could be felt to pulsate.

Owing to the firm walls, its cystic nature and soft contents, it being thought impracticable to remove the sac, the capsule was freely incised, the contents scraped out with the finger, and a tube introduced. The jaw was wired and a dressing applied.

The patient rallied well from the ether, swallowed, and spoke audibly. The tube was removed on the 18th of January. He was discharged, relieved, on the 20th. The bone had united, but there was still an opening on the cheek. He could then open the mouth one inch. Nothing abnormal could be seen in the throat except a slight œdema about the tonsil.

Case II. — Post-pharyngeal Sarcoma. Temporary Resection of Jaw at Angle. Removal of Tumor. Recovery.

The patient was a laborer, thirty-three years old, of correct habits and good family history, who first observed, about five months before admission to Hospital, a small tender lump, "like a gum-boil," on the inside of the left cheek. This opened spontaneously and was healed within a few days. A week later a second swelling, similar to the first, appeared. These did not break at once, but gradually increased in size, varying from time to time, but on the

whole becoming larger until within a week of entrance. Four days before his admission to the Hospital this swelling opened spontaneously, discharging a quantity of foul pus and blood. He has had a good deal of pain which he likens to toothache, but the teeth appear to be sound. He thought he had lost forty pounds within the past five months.

His condition on entrance was as follows: The heart, lungs, and abdominal organs appeared healthy. The left cheek was a good deal swollen, without increase of surface temperature, or marked tenderness. Slight enlargement of the glands at the angle of the jaw.

The left tonsil was swollen and red; and on the inside of the left cheek was a narrow ulcer, three inches long, extending from the first molar back well upon the tonsil. It had an irregular outline, and the edges were slightly everted and overhanging in places. The surrounding tissues were swollen, red, and indurated. He was given a solution of boric acid as a mouth wash, and iodide of potassium, forty-five grains daily.

Nov. 25, 1890, twenty-two days after entrance, he was examined under ether by Dr. Cheever. The tumor was found to be well back of the tonsil, and felt hard and firm. A small section, removed at a point near the ulcerated surface, was found to contain many caudate, spindle, and squamous cells.

Operation, by Dr. Cheever, November 29. A curved incision was made, commencing just below the ear, about an inch behind the ramus of the jaw, running downward and forward to a point about two inches back of the symphysis. At the angle of the jaw a straight incision was carried downward over the bone, at right angles to the first cut. Bone exposed at the angle, periosteum divided, and retracted on each side. After drilling the bone and introducing wire sutures the jaw was sawn through at the angle.

After the muscular attachments had been separated the finger was introduced, and came upon the growth, which was back of the pharynx. Without much difficulty the growth was removed with the finger. It was about the size of an

egg, and was not connected with the mouth except at the point of ulceration. The wound was packed with boracic gauze, after the bones had been wired. The operation lasted forty-five minutes and was well borne by the patient.

The packing was omitted on the third day, at which time he could swallow well. He was discharged three weeks after the operation, with the wound nearly healed. The throat seemed clear. [The temperature had never been above 100°.]

Case III. — Retro-pharyngeal Tumor. Temporary Resection of Inferior Maxilla. Removal of Tumor. Death from Exhaustion. No Autopsy.

The history of this case is incomplete, as the patient, a Chinaman, thirty-seven years old, could speak no English. He had had a swelling on the left side of the throat for about four weeks. He had been losing flesh for three months, and difficulty in swallowing and pain had increased rapidly. Heart's action was weak. There was a swelling on left side of face, about the angle of the jaw. The left tonsil was swollen and red, and the soft palate pushed forward.

Nov. 30, 1890, operation by Dr. Cheever. Before etherization the swelling behind the soft palate was punctured with a knife, but nothing escaped save a little blood. The patient was then etherized and a curved incision made from a point just below the ear, downward and forward, terminating about two inches from the symphysis of the jaw. A second straight incision was made running from the angle of the jaw downward and backward to meet the first one near its middle point. The periosteum was divided and pushed back, and the jaw sawn at the angle, after passing wires on each side. After the muscular attachments were separated the finger was introduced, and a tumor felt, which was attached to the prevertebral fascia as high as the posterior nares and as low as the cricoid cartilage. With some difficulty it was separated and removed piecemeal. All that could be felt was removed. The jaw was then wired and the wound packed with gauze.

The patient stood the operation fairly well, but could not

swallow in the afternoon. The packing was removed on the second day. From this time on the wound continued to do very well, but the patient could not be induced to take nourishment, and gradually lost ground. He died on the 29th of December, four weeks after the operation, from exhaustion. No autopsy was obtained.

GASTROTOMY.

Two cases of gastrotomy have been done for stricture of the œsophagus. The first by Dr. Gay on July 31, 1889. The patient had been failing for a year, and at the time of operation was only able to take an occasional mouthful of liquid nourishment, and was constantly hungry. The operation was successful, so far as it enabled the patient to appease the gnawings of hunger, but the patient lived only until August 25. Autopsy confirmed the diagnosis of cancer of the œsophagus.

The second case was done by Dr. Post on a patient of sixty-five. At the time when he came under observation he had had difficulty in swallowing solids for three months, which gradually increased in spite of repeated passage of œsophageal bougies. The operation was done on July 30, about six months after he first applied for help, though much longer time since the first symptoms. The stomach was stitched to the abdominal wall on that day, but was not punctured until the following day. At the time of the puncture the adhesions seemed firm, and the parts were so changed in appearance that it would have been difficult to recognize the stomach, except for the guidance of the sutures. The patient was fed through a gum-elastic catheter, and did remarkably well for a time. During one week he gained twelve pounds, was able to walk about, and smoke his pipe. The patient lived until December 30, dying at last, worn out. There was no autopsy.

The character of the constriction in this case can only be conjectured. There was nothing to be made out beyond the fact of a stricture which gradually closed. There were no glands to be felt in the neck or elsewhere. During November he had a good deal of cough and expectoration. The

amount raised varied a good deal from day to day. It was suspected at the time that there might be some extension of disease from the œsophagus into the trachea, and the material raised was examined, but no evidence of anything beyond an ordinary bronchitis was discovered.

ŒSOPHAGOTOMY.

Case I. Among the cases of œsophagotomy especial mention should be made of a case in which the œsophagus was opened by Dr. Gay, as a preliminary to the use of Simon's tubes. The case was one of malignant disease of the œsophagus, with gradual increase in the difficulty of swallowing. A pouch was known to exist in which a considerable amount of food lodged. Repeated attempts at intubation failed, and such severe attacks of dyspnœa were brought on by any instrumentation that further attempts in that direction were impossible. The œsophagus was opened low down on the left side, and the stricture examined by the finger. The œsophageal dilatation was found capable of holding two or three ounces. At the bottom of this sac the finger recognized a hard lobulated mass, the size of a hen's egg. The lower opening of the œsophagus was found on the anterior aspect of the pouch, and to the left. It was valvular, and received a sound as large as a No. 10 English catheter. A guide was then passed from the mouth, directed by the finger in the wound, into the continuation of the œsophagus. Upon this guide a Simons tube was passed, and on recovery from his anæsthetic the patient was able to drink quite freely, but a small portion of the liquid coming out through the wound. The operation was done May 17, and the patient remained quite comfortable for several weeks, though gradually failing. The tube was changed about every two weeks with some difficulty. July 13 the patient returned to the hospital with difficulty in breathing, and tracheotomy was performed. Quite an amount of pus was evacuated during the operation. The dyspnœa was greatly relieved, and the patient died, with comparatively little suffering, on the 15th.

In this case there was, of course, no hope of any curative action. The patient was rendered fairly comfortable, however, and euthanasia was practically reached.

Case II. Under the care of Dr. Gay. Five days previous to operation the patient was thrown from his cart, and a plate with four artificial teeth was knocked down his throat. This plate was located thirteen inches from the upper incisors, and four and a half inches below the level of the sternum. The plate was reached by forceps through the usual wound in the left side, and was removed with some difficulty. The patient was restless, delirious from the first, and died on the fifth day after the operation.

Case III. Dr. Gay. A child, aged three and a half years, was said to have swallowed a cent eight months previously. An œsophageal sound, passed with the child under an anæsthetic, met with resistance. Œsophagotomy was done by Dr. Gay, in the usual manner, on the left side. A uterine sound was utilized as œsophageal sound. The œsophagus itself was so small that it would not admit the little finger of the operating surgeon. The cent was found about two inches below the notch of the sternum, and was extracted through the wound by forceps. The next day the child was up in bed and quite lively. The following day there was a slight rise of temperature, but recovery was uninterrupted. The operation was done on October 16. On November 15 the child was brought to the Hospital for inspection. At that time the wound was entirely healed, and she was eating solid food as well as ever.

Case IV. Dr. Post. A little girl of twelve swallowed a quarter of a dollar, and came under operation on the fifth day. An attempt was made under ether to remove the coin with the probang, but it was firmly fixed. Œsophagotomy was immediately performed. The operation was practically bloodless, and was chiefly noticeable for the rapid recovery of the child. The day after the operation she was up, dressed, and playing about the ward. The wound united by first intention in its deeper parts, so that no food ever appeared through the wound.

Case V. Dr. Cheever. An epileptic man of thirty-five years swallowed a false plate and six teeth, in a convulsion. They lodged opposite the nipple; operation of œsophagotomy on the fourth day. Opening in œsophagus carried down to clavicle; long-continued efforts at extraction; finally successful. Died on the sixth day, of shock and exhaustion.

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